LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 5 | Technical Appendices

CFA18 | Stoneleigh, Kenilworth and Burton Green

Survey reports (CH-004-018)

Cultural heritage

November 2013

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Appendix CH-004-018

Environmental topic:	Cultural heritage	CH
Appendix name:	Survey report	004
Community forum area:	Stoneleigh, Kenilworth and Burton Green	018

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1 Introduction

1.1 Structure of the cultural heritage appendices

1.1.1 The cultural heritage appendices for the Stoneleigh, Kenilworth and Burton Green CFA (CFA18) comprise:

- Appendix CH-001-021 – Baseline report;
- Appendix CH-002-021 – Gazetteer of heritage assets;
- Appendix CH-003-021 – Impact assessment table; and
- Appendix CH-004-021 – Survey reports (this appendix).

1.1.2 Maps referred to throughout the cultural heritage appendices are contained in the Volume 5 cultural heritage map book.

1.2 Surveys undertaken

1.2.1 This appendix contains the results of extensive archaeological surveys undertaken. Key surveys reported in this appendix include:

- LiDAR survey of the majority of the land required, temporarily and permanently, to construct the Proposed Scheme plus 500m;
- hyperspectral survey of the majority of the land required, temporarily and permanently, to construct the Proposed Scheme plus 500m; and
- geophysical surveys at 2 locations along the route (CN015 and CN016) encompassing 18.9 and 2.3 hectares respectively.

1.2.2 The results of aerial photographic analysis have been incorporated into the baseline report in Appendix CH-001-018 and are not reported separately for this CFA.

2 LiDAR and hyperspectral survey report

2.1 Introduction

2.1.1 The Stoneleigh, Kenilworth and Burton Green CFA extends from Cubbington in the South to Burton Green in the North, and comprises largely rural landscape, stretching for some 9.6 km on a broadly north-west to south-east alignment. It passes to the north-east of the town of Kenilworth, to the west of the village of Stoneleigh and to the south-west of the outskirts of Coventry.

2.2 Methodology and limitations of analysis

LiDAR data

2.2.1 The filtered LiDAR data was used to create a Digital Terrain Model (DTM), and analysed in the GIS as three rasters comprising elevation data, a hillshade map and a slope map. Similarly, the unfiltered LiDAR data was used to create a Digital Surface Model (DSM) also analysed as elevation data, a hillshade map and a slope map.

2.2.2 Both the DTM and DSM were viewed as rasters in an ARCView GIS project. All identified features were digitised in the GIS from these rasters.

Hyperspectral data

2.2.3 The hyperspectral data was supplied as a series of ENVI DAT raster files, divided into 22 different sections (runs) covering the area of interest (CFAs 16 – 22). Each ENVI DAT contained 34 bands, representing a portion of the electromagnetic spectrum which included visible light and the near-infrared range. The data had a horizontal cell resolution of 1m.

2.2.4 A number of ArcGIS 10's out-of-the-box tools were used to extract, process and analyse the data. Initially, the ENVI DAT files were imported into a mosaic dataset stored within an ArcGIS 10 file geodatabase. A single combined raster dataset, containing the 34 bands, was created from the mosaic dataset.

2.2.5 As no more than three bands can be viewed at once using ArcMap (the red, green and blue bands of the raster dataset) there is a requirement to investigate subsets of the hyperspectral dataset. Particular attention was paid to the near-infrared and the visible red parts of the electromagnetic spectrum, due to the recognised potential of these in helping to highlight archaeological features (Parcak 2009, 101-2). The near-infrared range (760nm to 900nm on the electromagnetic spectrum) covered bands 6 to 13 in the hyperspectral dataset. The visible red range (605nm to 690nm on the electromagnetic spectrum) covered bands 18 to 22 in the hyperspectral dataset.

2.2.6 The near-infrared and visible red bands were extracted from the combined raster dataset, allowing for these bands to be viewed in isolation. Principal Component Analysis was also carried out on these bands using ArcGIS 10's Principal Components tool. The extracted bands were used to generate a series of single output raster datasets for both the near near-infrared and visible red hyperspectral data; this included a single principal component layer dataset and a multiple principal component layer dataset for both ranges. Different principal component layers could then be assigned to the red, green and blue bands of the multiple principal component layers raster datasets.

Digitising

2.2.7 All feature identification was undertaken manually and compared to the results of available aerial photograph evidence. Both hyperspectral and LiDAR plots were examined in detail and features and areas of likely archaeological potential were digitised manually using ArcGIS 10. These features can be seen in Table 1 below. Archaeological features have been assigned a unique WA number, and are briefly described. Where possible broad dates have been suggested based on the form of the features, and the identification of the features has been assigned a confidence rating (based on a simple five point scale (Low, Low to Moderate, Moderate, Moderate to High and High). Where possible, similar features with a common distribution (e.g. former field boundaries or ponds within a coherent area) have been grouped together.

Limitations

2.2.8 The LiDAR data used in the study if this CFA was largely confined to the land required, temporarily and permanently, to construct the Proposed Scheme, with very little coverage of the wider 500m study area. As a result of this the majority of the sites identified lie within the land required, temporarily and permanently, to construct the Proposed Scheme. It should also be added that there were some areas where the LiDAR data provided did not extend across the entire area of the land required, temporarily and permanently, to construct the Proposed Scheme, notably to the east and of Kenilworth where the land required, temporarily and permanently, to construct the Proposed Scheme, is widened to allow for the A46 corridor, although smaller areas to the north-east of Kenilworth and close to Stareton at the southern end of the CFA were also not covered.

2.2.9 Much of this stretch of the route is rural, and given over to farmland, although it does cross the built up and landscaped area of the National Agriculture Centre to the east of Kenilworth. Both of these have a slightly adverse effect on the use of the DSM as an interpretative tool. The crops covering much of the former when the LiDAR were flown appear to have been relatively well developed, and tend to mask the underlying terrain on the DSM, making it difficult to identify less pronounced earthworks and other landscape features. the built up nature and associated landscaping of the National Agriculture Centre makes it difficult to identify and features within this area with any certainty, either on the DSM or the DTM.

2.2.10 The DTM provides a model of the underlying terrain, stripping away crops and trees. As such it was particularly useful in allowing analysis of areas under crops, trees or woodland. However, even on the DTM, in some areas, low lying ground crops or piles or other obstructions have limited the effectiveness of the LiDAR, with the result that, in a few cases, the ground modelling is far from clear.

2.2.11 Unfortunately, the hyperspectral data provided did not contain bands representing the mid-infrared range (approximately 8500nm to 13000nm on the electromagnetic spectrum). The mid-infrared range is regarded as holding particularly high potential when attempting to identify archaeological features; the hyperspectral dataset contained no data beyond 992nm on the electromagnetic spectrum.

2.2.12 The horizontal cell resolution of the data also restricted the identification of smaller features (1m intervals) is also likely to have influenced the visibility of small archaeological features and lessened the clarity of some of the larger features.

2.2.13 The effectiveness of hyperspectral data in identifying archaeology can be significantly influenced by a number of factors, including the nature of the underlying geology, the water content of the ground and the type of ground cover. Significant areas of the route studied lie within dense woodland, where there is no likelihood of features being recognised through analysis of hyperspectral data, or beneath cereal crops, where the identification of features is likely to vary. Because of these variations, other techniques used for identifying areas of archaeological potential (notably the Normalised Vegetation Data Index (NVDI) and the Water Band Index) were not examined in detail.

2.2.14 The hyperspectral data supplied covered the land required, temporarily and permanently, to construct the Proposed Scheme and also covered the vast bulk of the 500m study area – the few exceptions comprise a small area of land close to Weston under Weatherley and a band of land close to the edge of the study area to the west of Stoneleigh – all some distance from the scheme. The overall coverage provided by the hyperspectral data is therefore excellent, although because of the number of variables affecting the visibility of features and the limitations in the bandwidth recovered, it should be noted that the features already identified are likely to represent only a portion of those within the CFA.

2.2.15 Despite these limitations, it is considered that the available LiDAR and Hyperspectral data provides comprehensive coverage of the land required, temporarily and permanently, to construct the Proposed Scheme, as well as providing evidence for much of the surrounding 500m study area.

2.3 Results

2.3.1 A total of fifty seven sites were identified on the various Hyperspectral and LiDAR plots within Community Forum Area 18. The bulk of these were identified on the LiDAR plots, with a smaller number also visible on the Hyperspectral imagery. These are listed in Table 1 below.

2.3.2 As might be expected, given the rural nature of the route, most of the sites and features identified relate to the agricultural exploitation of the area in the medieval, post-medieval and modern periods although a substantial stretch of dismantled railway runs along the length of the LLAU within this area (WA18.31). The sites identified largely comprise field boundaries, ponds, hollows (likely to either be infilled ponds or quarries) along with some areas of remnant 'ridge and furrow' agriculture. The latter developed through the ploughing regimes of the medieval and early post medieval periods, and can provide key evidence of the location and extent of medieval open field systems.

2.3.3 Well preserved areas of ride and furrow were recorded to the north-west of Stonehouse Farm (WA18.5) and along a considerable length of Finham Brook and in and around Millburn Grange (WA18.21, see Figure 1). The latter are clearly related directly to the site of the medieval Millburn Grange (WA18.27) where two sides of a substantial medieval or post medieval moat are evident, along with what appear to be at least two possible house platforms. A second ditched enclosure or small moated site, apparently not previously recognised, was identified slightly further to the south, close to the brook (WA18.23, see Figure 2). This may also mark the site of a medieval or post-medieval domestic complex. Further areas of ride and furrow were recorded in the vicinity of Stonehouse Farm (WA18.4 and WA18.5, see Figure 3).

2.3.4 Another moated site, also part of a wider landscape enclosed directly associated with ridge and furrow fields, was noted to the west of Bockendon Grange Farm (WA18.11 and WA18.12, see Figure 4). The LiDAR and Hyperspectral data did not extend far enough to the north-east to cover the site of the grange itself, but it is clear that it lies at the heart of an important relict medieval and post-medieval landscape.

2.3.5 Some of the areas of ridge and furrow earthworks are preserved within later woodland, including that to the north-west of Stonehouse Farm (WA18.5) and within Crackley Wood (WA18.29), Roughknowles Wood (WA18.32) and Broadwells Wood (WA18.34). Combined with the evidence for the creation of larger fields through the removal of many of the earlier boundaries, this can tell us much about the development of the landscape through the medieval and post-medieval periods. It seems clear that in some areas medieval farmland either reverted to woodland, or was perhaps planted for woodland.

2.3.6 In two areas, it is possible to suggest that the combination of different features identified allows us to reconstruct with some confidence relict landscapes. It seems clear that within this Community Forum Area, the landscape in and around Millburn Grange and that in the vicinity of South Hurst Farm can both provide us with much information about medieval land use and agricultural practice and how this changed and developed over time, and into the post-medieval period. The Bockendon Grange landscape is likely to be similar, judging from the small area to the south-west of it covered by the LiDAR and Hyperspectral data.

2.3.7 The likely site of a mill to the east of Daleshouse Farm was also identified (WA18.22). Whilst it is not clear exactly where the mill building may have stood, leats lead from Finham Brook in to a complex of earthworks to the east of the farm complex and then take the water back to the brook once more.

2.3.8 The land required, temporarily and permanently, to construct the Proposed Scheme, skirts to the south-west of Stoneleigh Park to the north-west of Stareton. This has its origins as a medieval and post-medieval deer park, and some of the larger earthworks visible on the LiDAR plots are likely to represent the remains of park pales (WA18.10).

2.3.9 Another feature of note within this CFA is the site of a former quarry to the west of Park Farm House, Stareton (WA18.9). A second probable quarry lies within Stoneleigh Park itself (WA18.12), whilst a former gravel quarry lies to the north-west of Dalehouse Farm (WA18.25). A long stretch of disused railway (WA18.31) testifies to the industrialisation of the wider area in the modern period.

2.4 Summary

2.4.1 The landscape within this area is largely a medieval and post-medieval creation, and this is reflected in the features identified, which are dominated by former field systems, including extensive areas of ridge and furrow, some later incorporated within woodland, former field boundaries and quarries/ponds, as well as some possible abandoned settlement all likely to be linked to post-medieval and modern agriculture. Concentrations of relict landscape features in the vicinity of Millburn Grange South Hurst Farm and to Bockendon Grange in particular mark these out as landscapes with potential to inform discussion on the evolution of the landscape in the medieval and post-medieval periods, with the contemporaneous parkland landscape of Stoneleigh Park providing an interesting contrast. The site of a probable medieval and post-medieval mill complex have also been identified, along with the sites of several former quarries. A railway line towards the northern end of this CFA attests to the coming of industrialisation to the area.

2.5 References

Parcak, S. H. (2009), Satellite Remote Sensing for Archaeology. Routledge, Abingdon.

2.6 Figures

Figure 1: Sites WA18.21, 18.24 and 18.27. Ridge and furrow (orange) and former field boundaries (red) in the vicinity of Millburn Grange (moat highlighted in pink) on LiDAR plots

Figure 2: Site WA18.23 and surrounding area. Possible moated site (green) and surrounding ridge and furrow and former field boundaries on LiDAR plot

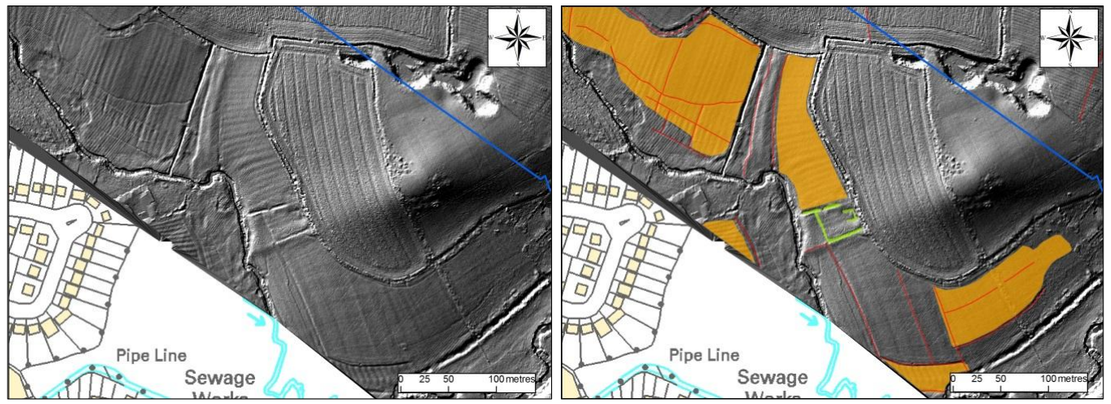

Figure 3: Sites WA18.4 and WA18.5. Ridge and furrow (blue and green) in the vicinity of Stoneleigh park (Hyperspectral Band 6 – Wavelength 900.945nm)

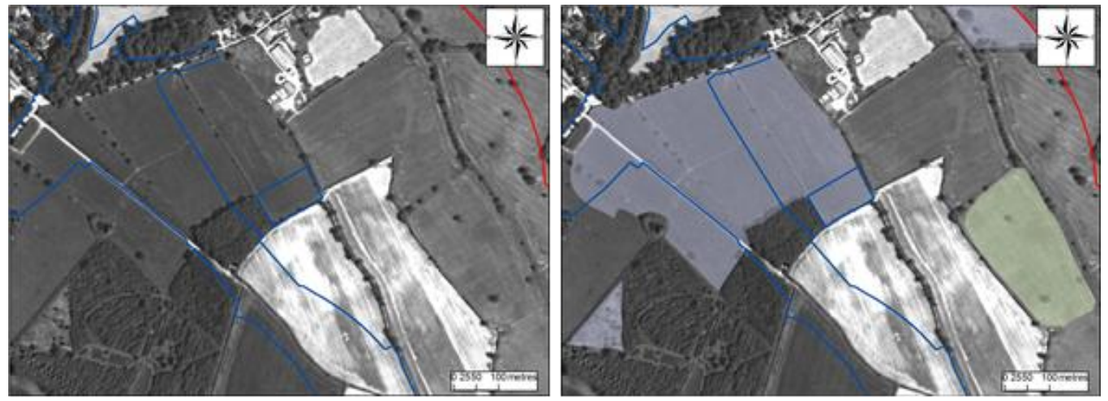

Figure 4: Sites WA18.37 Moated site (purple) and associated earthworks (WA18.38, green), including an area of former ridge and furrow to the west of Bockendon Grange Farm (Hyperspectral Band 9 – Wavelength 846.275nm)

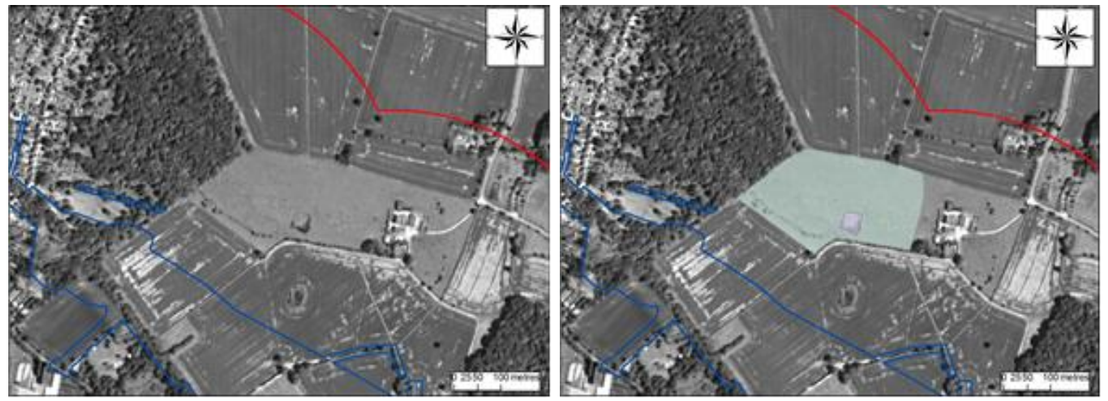

Figure 5: Anomalies within CFA18

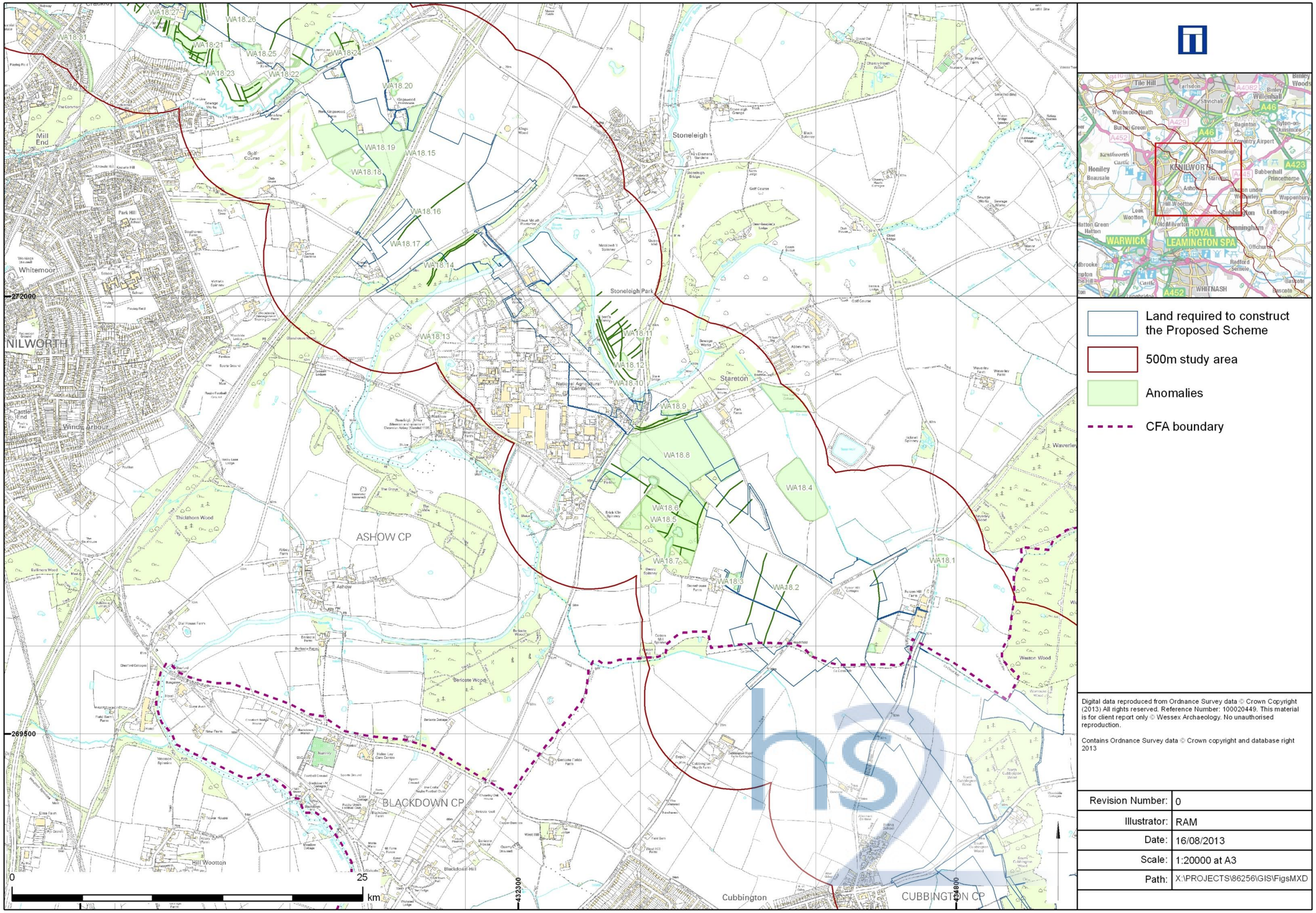

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Figure 6: Anomalies within CFA18

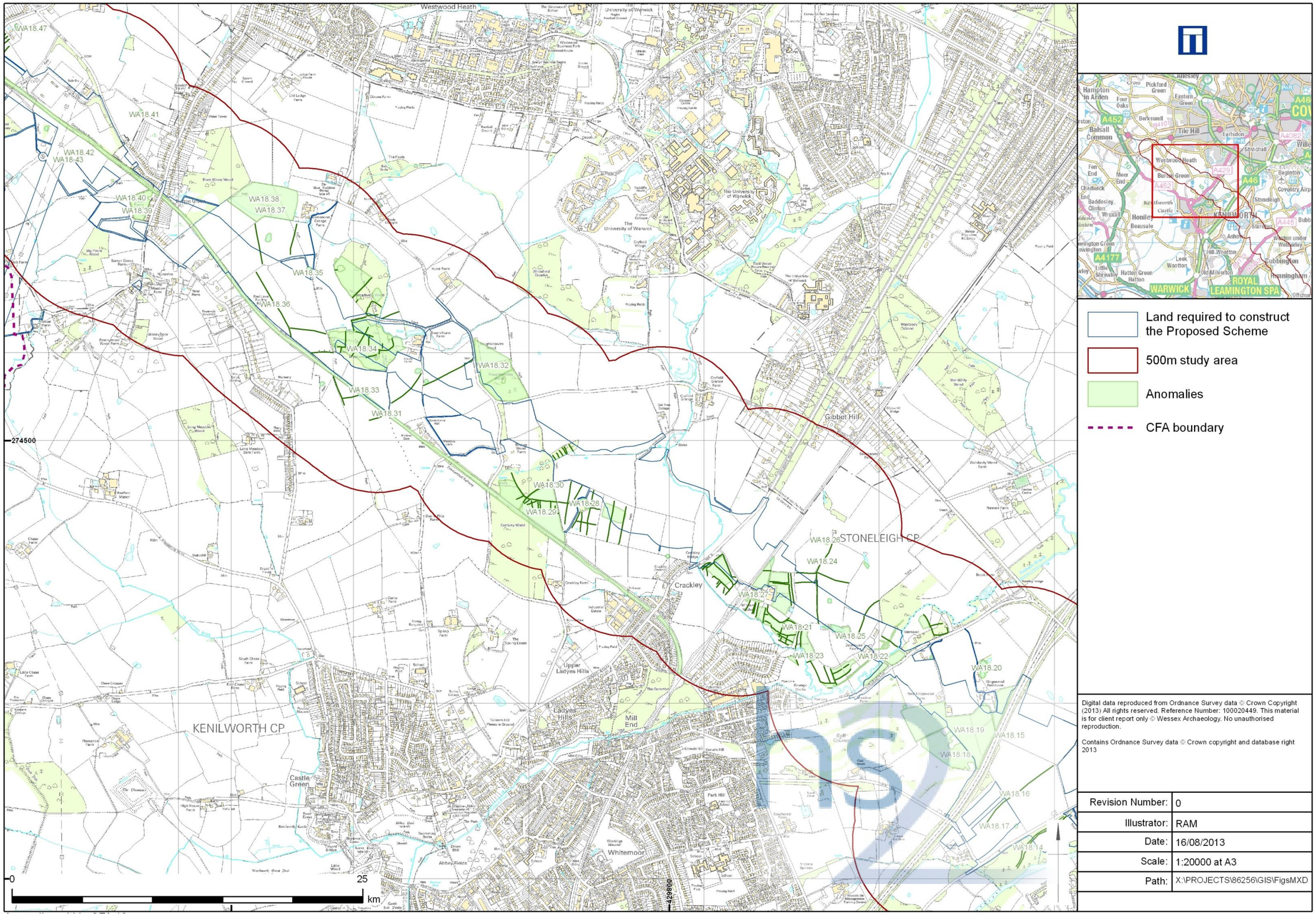

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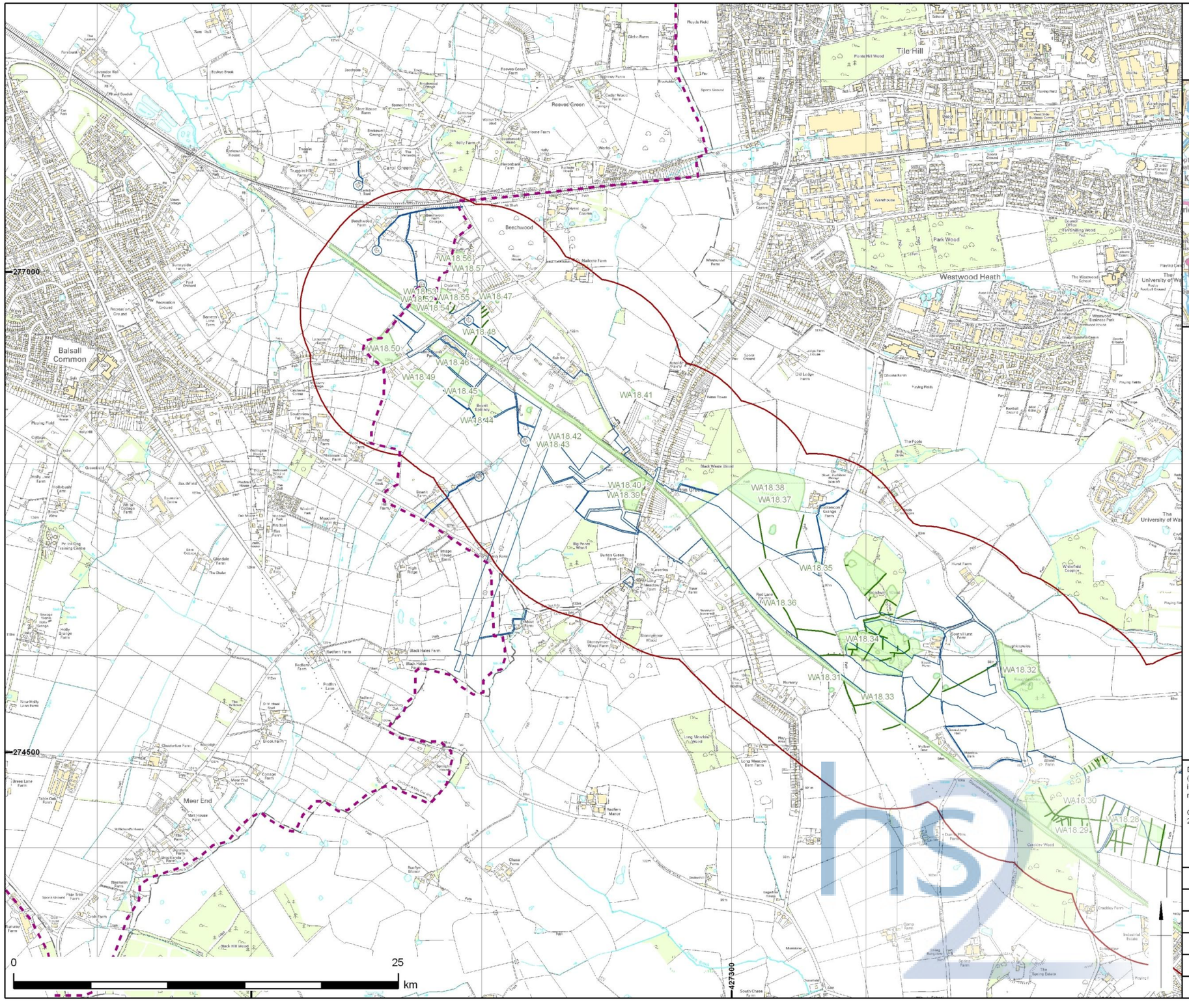
Figure 7: Anomalies within CFA18



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3 Identified sites

Table 1: Sites within CFA18

No	Site	Eastings	Northings	Description	Date	Confidence rating
WA18.1	SE of Stonehouse Farm	434320	269985	5 ponds in the fields between this farm and Furzen Hill Farm. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.2	SE of Stonehouse Farm	433765	270195	Series of linear earthworks representing the remains of former field boundaries. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.3	Stonehouse Farm	433520	270380	Area of remnant ridge and furrow immediately to the SE of the farm complex. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.4	W of Ticknell Spinney	433900	270900	Traces of ridge and furrow visible in large sub-rectangular field. Visible on Hyperspectral plots	Medieval/Post-medieval	Moderate to High
WA18.5	NW of Stonehouse Farm	433210	270760	Very well defined ridge and furrow aligned both NW-SE in woodland and NE-SW in one field not under woodland. Extends beyond the extent of the LiDAR data available	Medieval/Post-medieval	High
WA18.6	NW of Stonehouse Farm	433175	270700	Series of linear earthworks representing the remains of former field boundaries. Mostly in woodland. Tied in with ridge and furrow. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.7	NW of Stonehouse Farm	433210	270655	3 large irregular ponds within and on edge of woodland. Visible on LiDAR plots	Post-medieval/ Modern?	Moderate to High
WA18.8	SE of Stoneleigh Park	433200	271000	Faint traces of ridge and furrow visible in several fields to the south-east of Stoneleigh Park. Visible on Hyperspectral plots	Medieval/Post-medieval	Moderate to High
WA18.9	W of Park Farm House	433170	271340	Former quarry? Visible on LiDAR plots	Post-medieval/ Modern?	Moderate to High
WA18.10	Stoneleigh Park	432890	271590	Series of linear earthworks within the Park. The Larger earthworks around the edge may represent the remains of park pales. Visible on LiDAR plots	Medieval/Post-medieval/Modern	Moderate to High
WA18.11	Stoneleigh Park	432995	271770	2 ponds, one in the park, one just across the river. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.12	Stoneleigh Park	432915	271620	Area of probable quarrying. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.13	NW of Stoneleigh Park	431820	270940	Large irregular pond in wood. Visible on both Hyperspectral and LiDAR plots	Post-medieval/ Modern?	Moderate to High
WA18.14	E of Crewe Farm	431940	272270	Substantial linear earthwork on the slopes of the hill. Visible on LiDAR plots	Undated	Moderate to High
WA18.15	NE of Crewe Farm	431780	272300	2 ponds, one roughly oval, one sub circular. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.16	NE of Crewe Farm	431725	272450	Two linear earthworks representing the remains of former field boundaries. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.17	NE of Crewe Farm	431655	272290	2 roughly circular hollows. Possibly former quarries or ponds. Visible on LiDAR plots	Undated	Moderate
WA18.18	E end of golf course	431400	272700	Area of ridge and furrow beneath modern golf course and planting. On both a NW-SE and ENE–WSW alignment. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.19	S and W of Kingswood Farmhouse	431500	272800	Possible areas of ploughed out ridge and furrow. Visible on both Hyperspectral and LiDAR plots	Medieval/Post-medieval	Moderate
WA18.20	Near Kingswood Farmhouse	431600	273180	Series of 5 ponds in the vicinity of Kingswood Farmhouse, including 3 large ponds in a wood. Extends beyond the LiDAR data	Post-medieval/ Modern	Moderate to High
WA18.21	S of Millburn Grange	430790	273180	Fairly extensive remains of Ridge and furrow along river valley. On various alignment and in different states of repair. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.22	SE of Dalehouse Farm	431030	273350	Series of earthworks including leats leading both too and from the Finham Brook. Site of mill probably lies in the complex of earthworks to the east of the farmhouse. Visible on LiDAR plots	Medieval/Post-medieval?	Low to Moderate
WA18.23	SE of Millburn Grange	430620	273265	Small square field or enclosure containing a second smaller ditched enclosure. Domestic house platform/ditched enclosure? Respected by the ridge and furrow to the north. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.24	SE of Millburn Grange	430530	273370	Series of linear earthworks. Visible on LiDAR plots representing the remains of former field boundaries – defining smaller fields in the river valley and larger fields on the plateau. Visible on LiDAR plots	Medieval/Post-medieval/Modern	Moderate to High
WA18.25	NW of Dalehouse Farm	430790	273415	Former gravel quarry pit to the NW of the farm. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.26	NE of Millburn Grange	430715	273580	Series of 3 ponds. Possibly the remains of former quarries. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.27	Millburn Grange	430280	273620	Two sides of a possible moat visible, whilst to the south-west lies a pair of possible house platforms. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High

No	Site	Eastings	Northings	Description	Date	Confidence rating
WA18.28	N of Crackley	429310	274140	Four ponds to the N of Crackley. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.29	Crackley Wood and E of Crackley Wood	429085	274100	Traces of ridge and furrow visible in the triangular field to the east of the wood, with a smaller area in a field further to the east. Some visible in wood itself. Seen on both Hyperspectral and LiDAR data	Medieval/Post-medieval	Moderate
WA18.30	N of Crackley	429010	274165	Series of linear boundaries, probably the remains of former field boundaries and drainage ditches. Especially well preserved within the woodland. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.31	SE of Burton Green	427620	275085	Long stretch of disused railway. Seen on both Hyperspectral and LiDAR data	Modern	High
WA18.32	Roughknowles Wood	428875	474800	Area of former ridge and furrow in area of woodland, on both an ENE-WSW and a WNW-ESE alignment. N area less well preserved. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.33	S and SW of South Hurst Farm	428365	274895	5 ponds to the S and SW of South Hurst Farm. 4 lie on modern field boundaries. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.34	W and SW of South Hurst Farm	428060	275020	Extensive areas of former ridge and furrow, much of it in Broadwells Wood in area of woodland, on both an N-S and a NE-SW alignment. Extends beyond the LiDAR data available	Medieval/Post-medieval	Moderate to High
WA18.35	W of South Hurst Farm	428030	275310	Numerous ponds to the west of the Farm, many in Broadwells wood, apparently fed by drainage ditches. 10 in all. Visible on LiDAR plots	Medieval/Post-medieval/Modern	Moderate to High
WA18.36	W of South Hurst Farm	428065	275100	Series of linear boundaries, probably the remains of former field boundaries and drainage ditches. Especially well preserved within the woodland. Visible on LiDAR plots	Medieval/Post-medieval/Modern	Moderate to High
WA18.37	W of Bockendon Grange Farm	427525	275815	Moated site clearly visible to the west of Bockendon Grange Farm. Seen on both Hyperspectral and LiDAR data	Medieval/Post-medieval	High
WA18.38	W of Bockendon Grange Farm	427500	275860	Area of earthworks surrounding moated site. Visible as slight anomalies Seen on both Hyperspectral and LiDAR data	Medieval/Post-medieval	High
WA18.39	Little Poors Wood	426790	275830	Area of ridge and furrow within Little Poors Wood, on an ENE-WSW alignment. Visible on LiDAR plots	Medieval/Post-medieval	Moderate to High
WA18.40	North West of Little Poors Wood	426720	275880	2 ponds, one on edge of wood, second on edge of field to NW. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.41	SW of Arnold Farm	426795	276365	2 ponds on edge of field. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.42	E of Beanit Spinney	426365	276155	Large oval hollow in field. Possibly a former quarry or pond. Visible on LiDAR plots	Undated	Moderate to High
WA18.43	E of Beanit Spinney	426365	276155	2 sets of interlinked ponds in the fields to the east of the woodland. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.44	Beanit Spinney	425970	276225	2 substantial ponds on the edge of the woodland linked by ditches. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.45	SE of Little Beanit Farm	425890	276380	Area of former ridge and furrow. Aligned both NE-SW and NW-SE	Medieval/post-medieval	Moderate to High
WA18.46	SE of Little Beanit Farm	425840	276525	Area of former ridge and furrow. Aligned NW-SE. Visible on LiDAR plots	Medieval/post-medieval	Moderate to High
WA18.47	E of Crabmill Farm	426080	276855	Two ponds very close to Crabmill Farm, one to the east of Waste Lane. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.48	N and NE of Laburnum Farm	425990	276700	Series of linear boundaries, probably the remains of former field boundaries and drainage ditches. Visible on LiDAR plots	Post-medieval/ Modern	Moderate to High
WA18.49	SE of Waste Lane	425660	276430	Area of former ridge and furrow. Aligned NW-SE. Extends beyond limit of LiDAR data to SW.	Medieval/post-medieval	Moderate to High
WA18.50	NW of Waste Lane	425485	276600	Area of ridge and furrow in the field to the NW of Waste Lane. Seen on both Hyperspectral and LiDAR data	Medieval/Post-medieval	Moderate to High
WA18.51	SW of Crabmill Farm	425770	276880	Former linear field boundaries directly associated with poss. platforms and ridge and furrow	Medieval/Post-medieval/ Modern	Moderate to High
WA18.52	SW of Crabmill Farm	425670	276850	Two possible ditched enclosures or house platforms	Medieval/post-medieval	Moderate to High
WA18.53	SW of Crabmill Farm	425685	276900	Area of former ridge and furrow. Aligned NE-SW.	Medieval/post-medieval	Moderate to High
WA18.54	SW of Crabmill Farm	425730	276850	Area of former ridge and furrow. Aligned NW-SE.	Medieval/post-medieval	Moderate to High
WA18.55	SW of Crabmill Farm	425820	277075	Area of former ridge and furrow. Aligned NW-SE.	Medieval/post-medieval	Moderate to High
WA18.56	SW of Stone House	425770	277075	Area of former ridge and furrow. Aligned NNE-SSW and WNW-ESE.	Medieval/post-medieval	Moderate to High
WA18.57	Stone House	425930	277020	Irregular pond just to the S of the farm.	Post-medieval/ Modern	Moderate to High

4 Geophysical surveys

4.1 CN015 land off Coventry Road (A429), near Kenilworth, Warwickshire

Introduction

Project background

4.1.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN015 off Coventry Road (A429), near Kenilworth, Warwickshire (Figure 8), hereafter "the site" (centred on NGR 430475 273700). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.1.2 This site, CN015, was selected for geophysical survey as it is located close to known archaeological remains including a possible Deserted Medieval Village (DMV). It is considered to be an area at high risk (risk model score: 2).

Site details

4.1.3 The site comprises five fields located off Coventry Road (A429) around Millburn Grange Farm. The site lies approximately 2km northeast of the centre of Kenilworth. The limits of the geophysical survey area are defined by field boundaries for much of the area with the northern limits defined by the client. The site comprises five fields; three were under a young cereal crop and two were areas of pasture close to the farm complex. A railway divides the site into two with the large western arable field separated from the other four fields. Geophysical survey was undertaken over all fields with only a small area lost to obstructions. The area of data coverage came to around 18.9ha.

4.1.4 The site lies on an area of gently sloping land that falls away towards the southeast. The northwest region of the survey area lies at a height a little over 80m aOD (above Ordnance Datum) and falls from this height to less than 75m aOD at the southeast corner of the site. The site occupies the southwest facing slope of the valley of Canley Brook. This watercourse flows into Finham Brook which flows northwest to join with the River Sowe, close to its confluence with the River Avon.

4.1.5 The solid geology is recorded as barren upper coal measures and pennant series (Carboniferous) with Keuper sandstone (Triassic) close by (Ordnance Survey 1957). There are superficial deposits recorded close to the site with river terrace deposits (Quaternary) recorded nearby (Ordnance Survey 1977).

4.1.6 The soils underlying the north-western half of the site are likely to be stagnogleyic argillic brown earths of the 572e (Whimple 2) association. The soils underlying the south-eastern half of the site are likely to be typical brown earths of the 541b (Bromsgrove) association (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

4.1.7 There are two records of archaeological sites located within the survey area. The most significant record is of the possible Deserted Medieval Village (DMV) of Millburn. A series of earthworks are considered to represent the remains of the settlement that is located in the westernmost field inside the survey area (MWA2923). Further to the southeast is a record of Millburn Grange; this site is located over the area of the current farm. The grange was a medieval Cistercian estate associated with Stoneleigh Abbey (MWA8364).

4.1.8 Several other records are located outside of the survey area ranging in date from the prehistoric through to post-medieval and modern periods. A flint tool dating to either the Neolithic or the Bronze Age was uncovered in a garden in Highland Road, Kenilworth, south of the survey area (MWA3267). To the northwest of the survey area are undated linear features that are visible as cropmarks on aerial photographs; they are located on the western side of Coventry Road (A429) (MWA4803). To the southwest of these linear cropmarks is the findspot of several Roman coins (MWA2882). Southeast of the survey area, just outside, is a record of gravel pits that were thought to be in use between the post-medieval period and the beginning of the twentieth century (MWA6936), another quarry is located to the northeast (MWA2876). Crackley Bridge, located along the A429 southwest of the survey area, is thought to date from at least the post-medieval period and spans Canley Brook.

Methodology

Survey objectives

4.1.9 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
- to clarify the presence/absence and extent of any buried archaeological remains within the site; and
- to determine the general nature of the remains present.

4.1.10 This report presents a brief description of the methodology followed, the detailed survey results and the archaeological interpretation of the geophysical data.

Survey dates

4.1.11 A detailed gradiometer survey was carried out by Wessex Archaeology's in-house geophysics team between 13th and 16th May 2013.

Grid location

4.1.12 The individual survey grid nodes were established at 30m x 30m intervals using a Leica Viva RTK GNSS instrument, which is precise to approximately 0.02m and therefore exceeds English Heritage recommendations (EH 2008).

4.1.13 A representative sample of survey grid nodes (around 10%) were re-surveyed in the mornings in the event they were left out in the field overnight. This was undertaken along with a visual inspection of entire lines of grid nodes to ensure the survey grid remained accurate for the entire survey.

Instruments used and survey method

4.1.14 The magnetometer survey was conducted using a Bartington Grad601-2 fluxgate gradiometer instrument, which has a vertical separation of 1m between sensors. Data were collected at

0.25m intervals along transects spaced 1m apart with an effective sensitivity of 0.03nT, in accordance with EH guidelines (EH 2008).

4.1.15 Data were collected in the zigzag method with grids oriented north to south (Grid North). The first direction walked for each grid was heading towards the north.

Data processing

4.1.16 Data from the survey was subject to minimal data correction processes. These comprise a zero mean traverse (ZMT) function (±7nT thresholds) applied to correct for any variation between the two Bartington sensors used, and a de-step function to account for variations in traverse position due to varying ground cover and topography. The deslope function was applied to selected grids to balance out minor grid edge errors that were created by the ZMT function. These three steps were applied to all survey data, with no interpolation applied.

4.1.17 Further details of the geophysical and survey equipment, methods and processing are described in Appendix 1.

Data presentation

4.1.18 The processed gradiometer data were output as .png image files and georeferenced in CAD (AutoCAD Map 3D 2011); these images were exported as georeferenced .png image files (accompanied by .pgw files). The interpretation layers were digitised in CAD and the resulting interpretation layers were exported as ESRI shapefiles, in accordance with the specification. The data images and interpretation shapefiles were then passed to our graphics team who produced the final figures in GIS (ESRI ArcMap 10).

4.1.19 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

Introduction

4.1.20 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and at least three modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figure 9 to Figure 14).

4.1.21 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (Figure 11 and Figure 14). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

4.1.22 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

4.1.23 The greatest concentration of potential archaeological features lies towards the western end of the site, within the westernmost field. Most of these anomalies have very weak magnetic values with typical values less than +2nT, this weak contrast suggests that many more features may be present than are visible in the geophysical data.

4.1.24 There are two linear positive anomalies at 4000; they both have weak magnetic values and are aligned roughly northeast to southwest. These features are considered to represent ditches and have been classed as archaeology (weak response).

4.1.25 Further to the east around 4001 are another group of positive anomalies including three linear and curvilinear ditch-like anomalies crossing one another. One is a curving ditch that is crossed by or crosses an L-shaped ditch and the third is a linear feature that runs through the L-shaped ditch, perpendicular to it. The L-shaped ditch is on a similar alignment to the ditches at 4000 and may form part of an enclosure, the curving ditch may represent a feature that is not contemporary with these ditches. All of these features are classed as archaeology (weak response).

4.1.26 In addition to the ditches at 4001 are a closely packed group of small sub-oval shaped positive anomalies and slightly larger elongated positive anomalies. The larger examples tend to have much weaker magnetic values, similar to the ditches discussed above and the smaller ones tend to have stronger magnetic values, typically over +2nT. These features are considered to represent cut features such as short sections of ditch and smaller features such as pits and postholes. Some of the smaller, stronger anomalies may prove to be part of small ferrous anomalies that do not have an obvious negative region associated with it. These anomalies have mostly been classed as possible archaeology with the weaker and stronger magnetic anomalies separated into two different categories.

4.1.27 Two small sub-oval shaped positive anomalies are located at 4002 and 4003; they are both slightly larger than other similar anomalies in the vicinity with magnetic values over +2nT. They are both considered to represent pits and are both classed as archaeology.

4.1.28 Some more ditch-like anomalies are located around 4004 and 4005; they are quite a bit fainter than other examples observed around 4000 with values around +1nT. These features are linear and L-shaped and are considered to represent ditches. They have been interpreted as possible archaeology (weak response) due to their weaker magnetic values.

4.1.29 Another linear positive anomaly is present to the south at 4006; it has typical magnetic values around +2nT and is considered to represent a ditch. Another linear is present at 4007; this anomaly has negative magnetic values around -1nT. This feature is considered to represent a ditch with a sterile fill that is less magnetic than the background soil. This feature could represent a drainage ditch that was regularly cleaned out to keep the land well-drained. These two anomalies appear to define the eastern extent to the dense concentration of archaeological responses and are both classed as archaeology (weak response).

4.1.30 The area to the west of 4006 and 4007 has a noisier, variable background. There are concentrations of weak bipolar anomalies (black and white) across the area that have been interpreted as industrial, burnt-fired, increased magnetic response. This region could either constitute a build-up of magnetically enhanced debris as a result of anthropogenic activity in this area or could represent a change in the geology. Given the concentration of archaeological features in this area an anthropogenic cause is considered more likely.

4.1.31 The remaining anomalies of interest consist of small, sub-circular or sub-oval shaped positive anomalies and weak linear trends. The small positive anomalies are considered to possibly represent cut features such as small pits and postholes although geological explanations are also possible. The weak trends are considered to either represent ploughing trends set at an angle to the prevailing direction of ploughing or are weak archaeological features. As there is

no significant patterning in their spatial distribution they have been classed as possible archaeology (small positive anomalies) and uncertain origin (trends).

4.1.32 There are numerous ceramic field drains present in the eastern half of this field with two orientations of drains present at 4008 and 4009. There are numerous ploughing trends across the whole of this field that are considered to be relatively modern.

4.1.33 A modern service is present at 4010; this will be discussed in more detail below. The remaining anomalies are a couple of irregularly shaped, weakly positive features that are considered to be geological such as at 4011.

4.1.34 The field to the immediate east of the railway contains few anomalies of interest; the dominant features are trends of uncertain origin and small positive anomalies of possible archaeological interest such as those around 4012. There is a spread of increased magnetic response around 4013 but this is likely to relate to the nearby ferrous and the farm.

4.1.35 The field to the northeast contains few anomalies of interest aside from linear trends of uncertain origin and small positive anomalies of possible archaeological interest such as those around 4015 and 4016. There is a spread of increased magnetic response that continues from the westernmost field. It is unclear whether this represents a spread of debris relating to archaeological activity or debris deposited during the construction of the railway.

4.1.36 A modern service is present at 4018; this will be discussed in more detail below. The remaining anomalies are a couple of irregularly shaped, weakly positive features that are considered to be geological such as those around 4017.

4.1.37 The field to the south contains a number of quite noticeable trends around 4019; these are considered to either represent ridge and furrow or some form of drainage system. There are very few anomalies of interest in this field apart from one linear ditch-like anomaly north of 4021; this is considered to represent a ditch. The remaining anomalies of potential interest are linear trends of uncertain origin such as at 4020 and small sub-oval shaped positive anomalies of possible archaeological interest.

4.1.38 Two services run through this field at 4021 and 4024 along with two regular ferrous anomalies at 4022 and 4023 that may be related in some way. These services will be discussed in more detail below.

4.1.39 The largest field lies to the east and contains several anomalies of interest. There are three pit-like anomalies at 4025, 4026 and 4027; 4025 is by far the largest with a diameter of 2.8m and magnetic values that exceed +3nT. These features are considered to represent pits and have been classed as archaeology.

4.1.40 An interrupted linear positive anomaly is present at 4028 and 4029; the feature is considered to be a ditch and is interrupted by ferrous anomalies, a service and regions of increased magnetic response. The magnetic values along the ditch vary considerably with values over+3nT at 4028 and values around+1nT at 4029. This feature has been classed as either archaeology or possible archaeology (weak response) depending on the magnetic values.

4.1.41 A weak linear negative anomaly is present at 4030; this feature is considered to represent a ditch similar to the one at 4007 and is also thought to be related to drainage. This feature has been termed possible archaeology (weak response) as it is not quite as regular in form as 4007.

4.1.42 The line of ferrous and increased magnetic response at 4031 is known to be a former field boundary that was removed within the last few years. A large pond is visible as a large ferrous response to the east of 4031. This pond may relate to quarrying activity that is recorded nearby.

4.1.43 The service at 4032 will be discussed in greater detail below. There are spreads of increased magnetic response in this field such as at 4033; this spread is considered to either represent a spread of magnetic anthropogenic debris or a variation in the underlying geology.

4.1.44 There are numerous trends related to ploughing right across this field although there is an area in the southeast of the field around 4034 with slightly different trends. These are interpreted as ridge and furrow given that they look similar to the anomalies around 4019.

4.1.45 The remaining anomalies of interest are weak trends interpreted as uncertain origin and small positive anomalies of possible archaeological interest such as those around 4035. Some of these anomalies may prove to be archaeological whereas others may prove to be ploughing scars, ferrous or geological. They are considered to be of possible archaeological interest as they are very numerous and their distribution does not form any significant patterning. The last group of anomalies present are some weak geological features such as the example at 4036.

Interpretation: modern services

4.1.46 Three modern services have been identified in the data at 4010, 4021 and 4024; the service at 4010 appears to be a metallic/ceramic pipe that is running parallel to the railway line and 4021 and 4024 appear to be cables. There are other anomalies such as 4022 and 4023 that appear to be isolated sections of cable but it is unclear what these features are and it is not clear whether they form part of an active service.

4.1.47 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

4.1.48 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site, in addition to regions of increased magnetic response, numerous trends of uncertain origin and at least three modern services.

Discussion

4.1.49 The data shows a number of archaeological features that may be associated with records of a possible DMV and a medieval grange. The anomalies that are labelled 4000 to 4007 are considered to be most relevant to these records. The medieval settlement is thought to be located further to the southwest, closer to the stream, but this area may represent an extension of the settlement running along the road or could represent agricultural features associated with the settlement.

4.1.50 There are several other likely archaeological features located within the site, most notably 4025 to 4028, these features are considered to represent pits and ditches but it is unclear as to the period they could date to.

4.1.51 Although it shows as a large ferrous anomaly in the data, the pond located to the east of 4031 may be related to post-medieval quarrying activity. Although no record exists for this feature it is considered likely to be the result of quarrying.

4.1.52 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.

4.1.53 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

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Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.

Ordnance Survey (1957), Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.

Wessex Archaeology (2013), HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86254.01.

HER records consulted

MWA2923 – Millburn Deserted Medieval settlement

MWA8364 – Millburn Grange

MWA3267 – Findspot, Neolithic or Bronze Age flint tool

MWA4803 – Undated linear cropmark

MWA2882 – Findspot, Roman coins

MWA6936 – Site of Gravel Pits NW of Dale House

MWA2876 – Quarry in "Pit Field", to S of Gibbet Hill

MWA2934 – Crackley Bridge

Figures

Figure 8: Site location

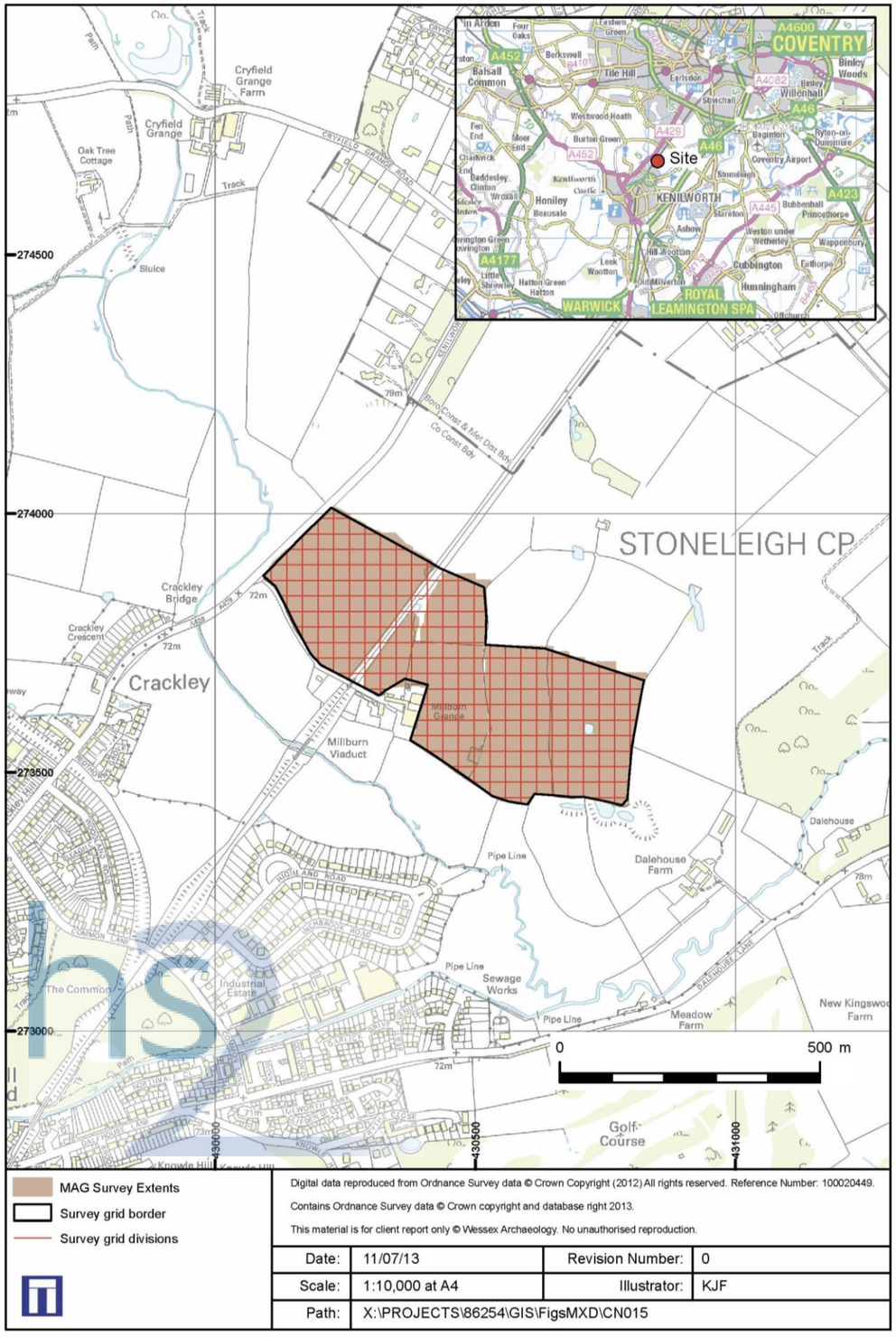


Figure 9: Greyscale plot: North-west

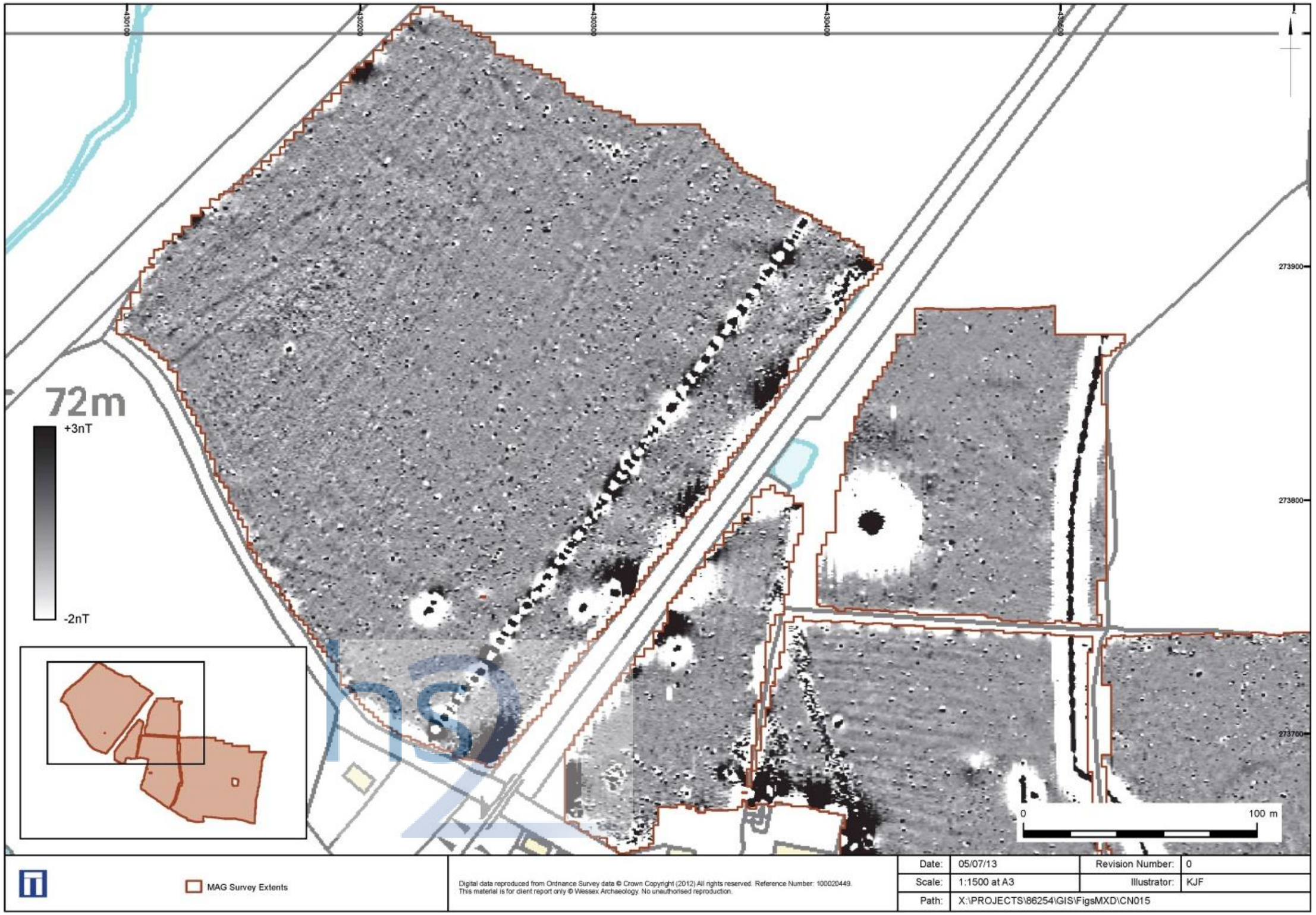


Figure 10: XY trace: North-west

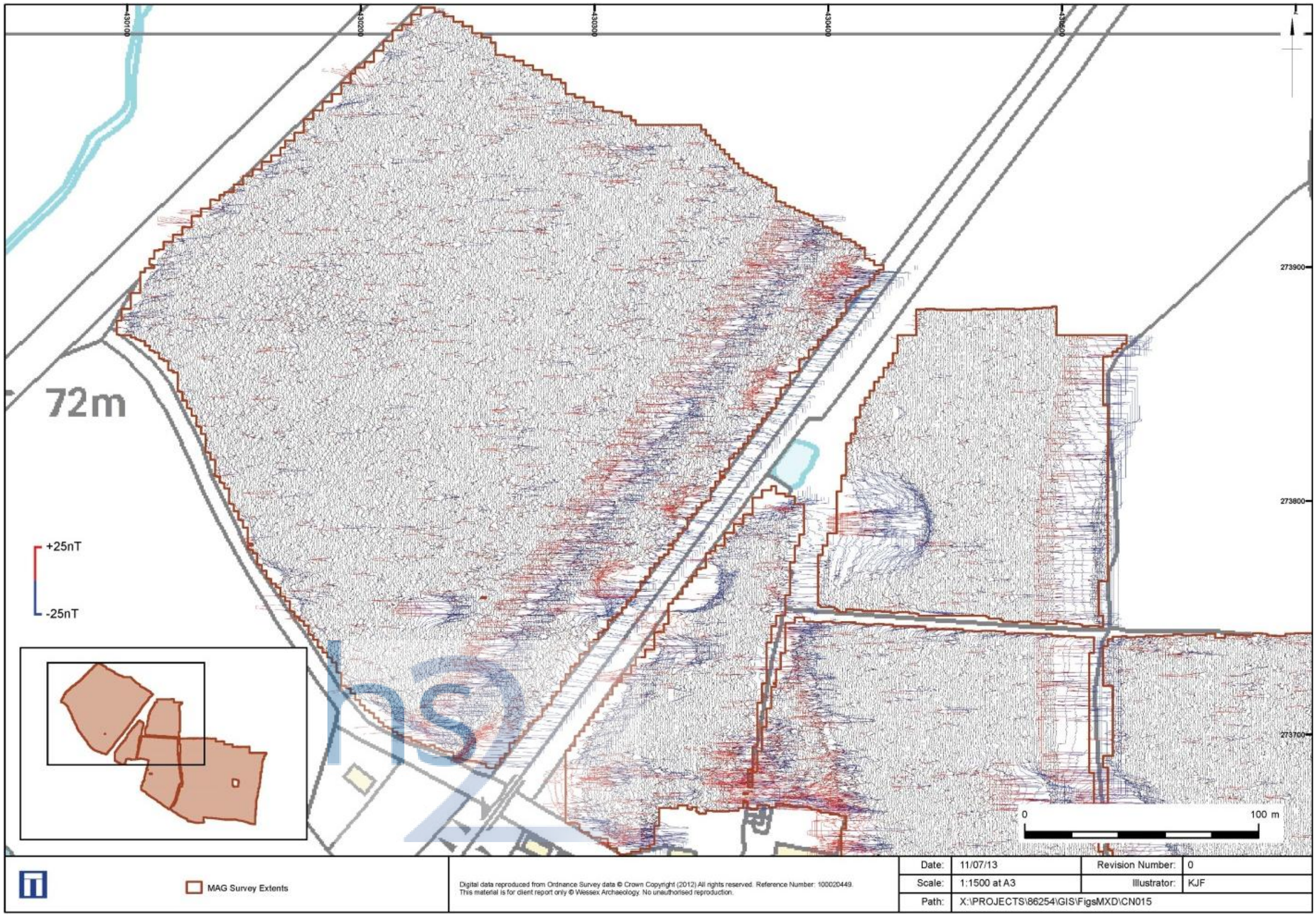
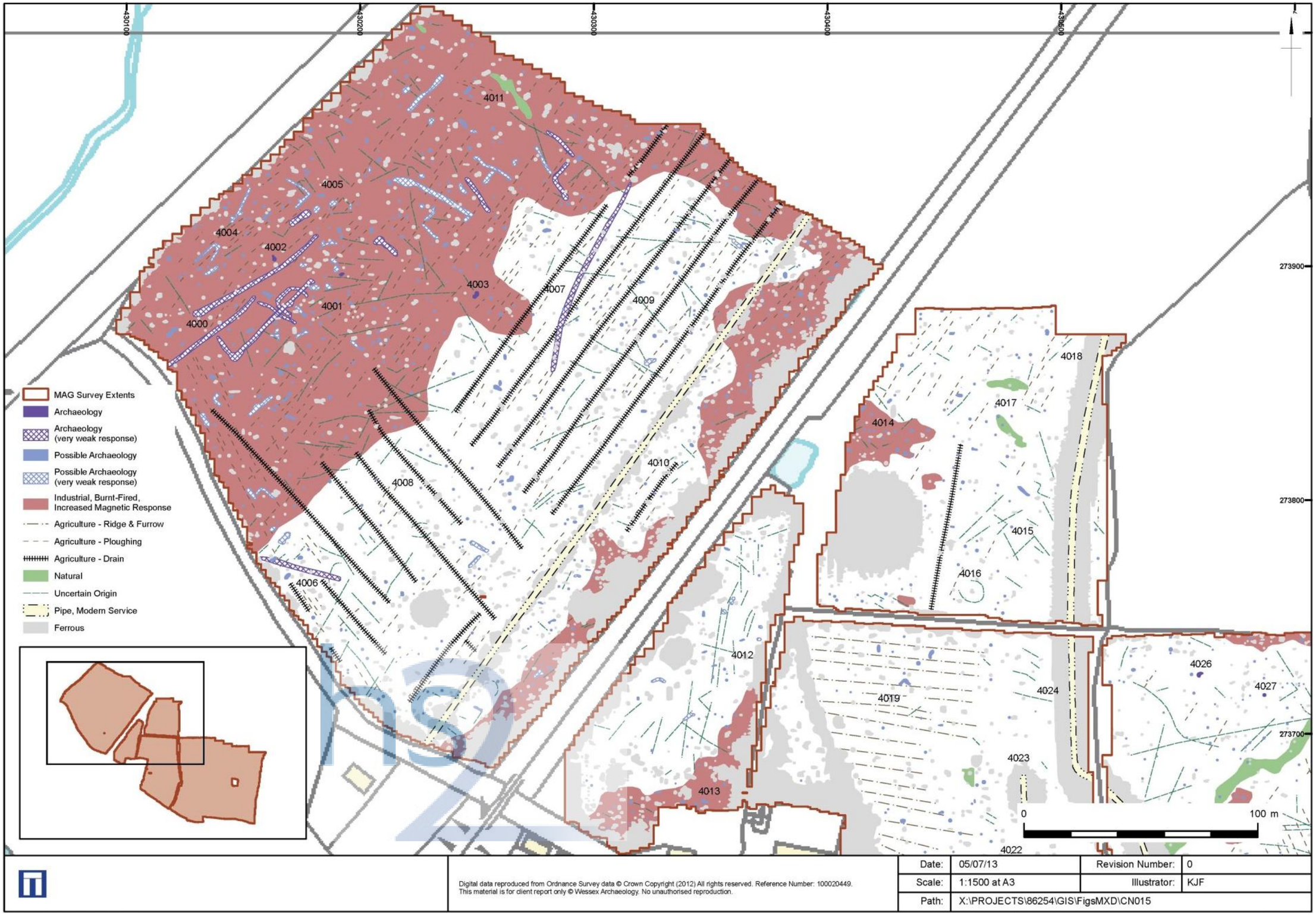


Figure 11: Interpretation: North-west



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Scale:	1:1500 at A3	Illustrator:	KJF
Path:	X:\PROJECTS\86254\GIS\FigsMXD\CN015		

Figure 12: Greyscale plot: South-east

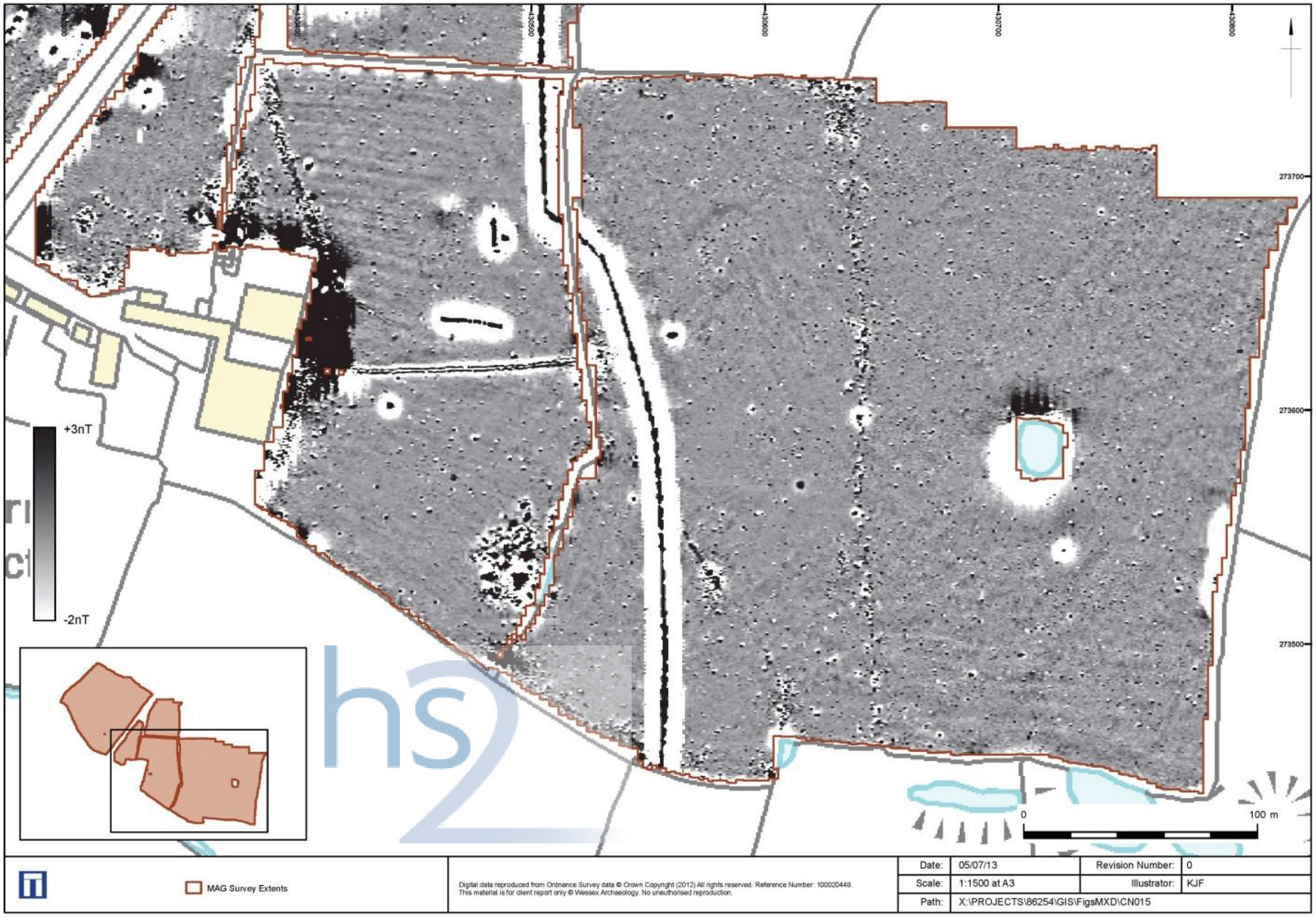


Figure 13: XY trace: South-east

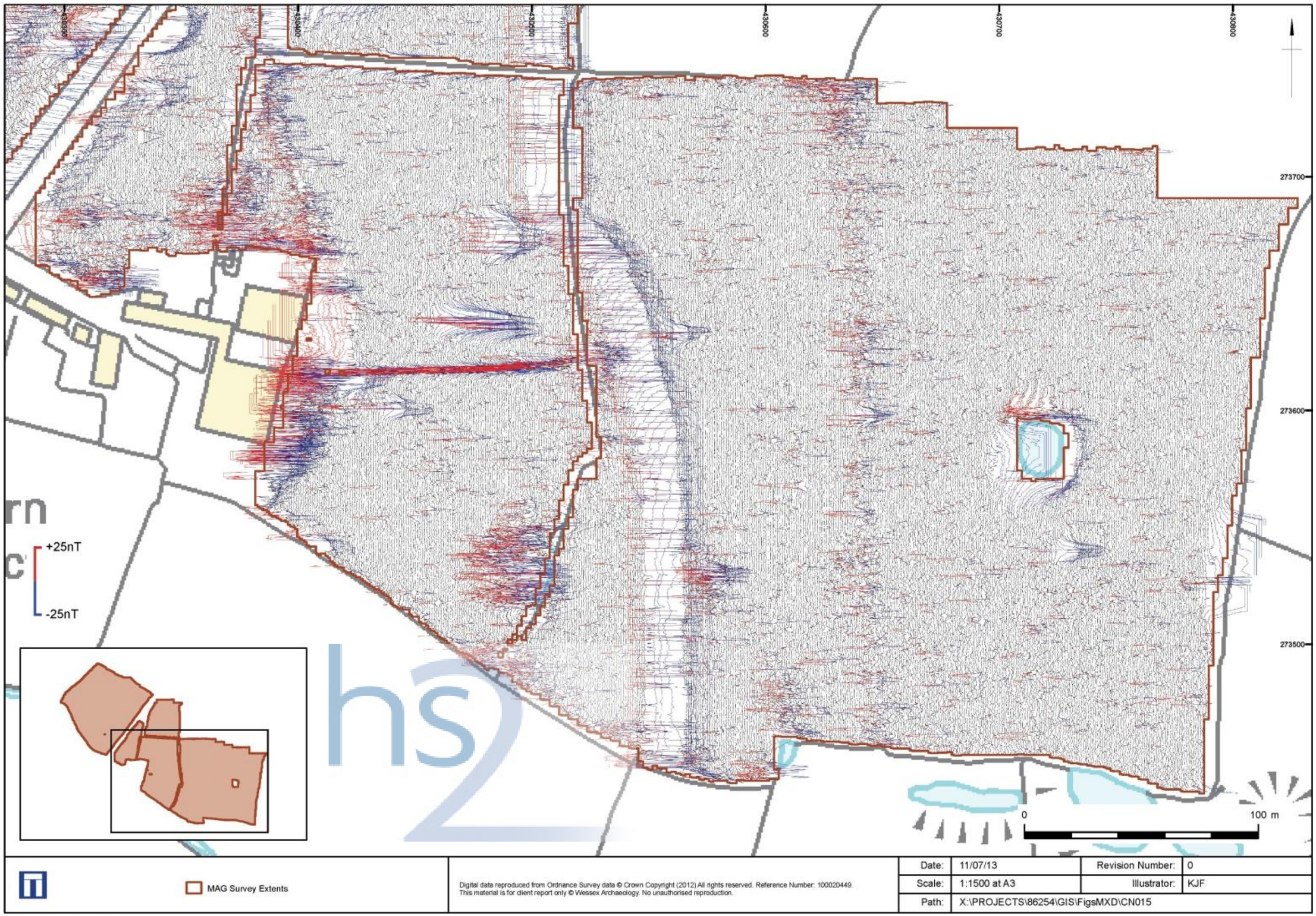
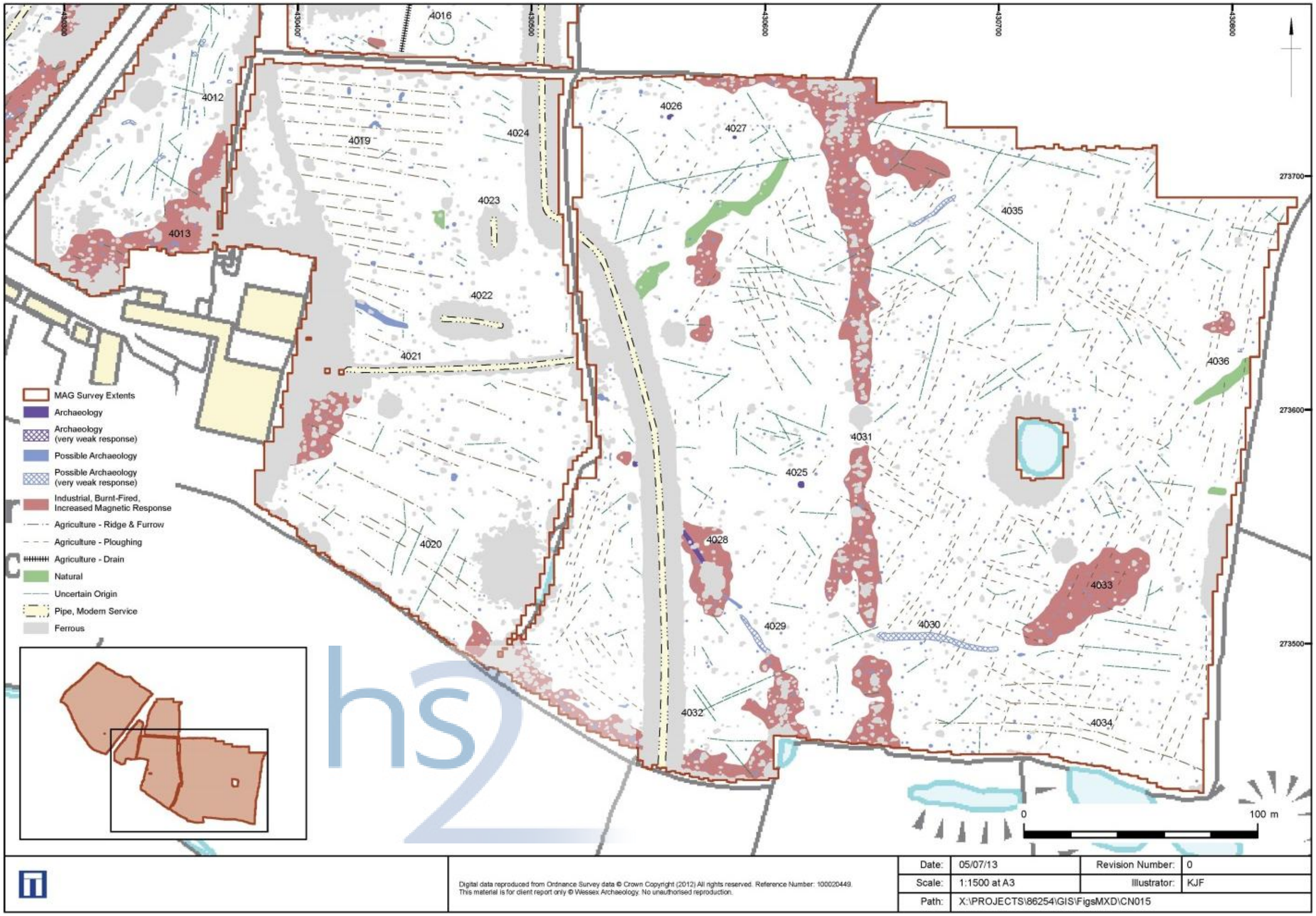


Figure 14: Interpretation: South-east



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4.2 CN016 land off Coventry Road (A429), near Kenilworth, Warwickshire

Introduction

Project background

4.2.1 Wessex Archaeology was commissioned by Atkins, on the behalf of HS2, to carry out a geophysical survey of area CN016 off Coventry Road (A429), near Kenilworth, Warwickshire (Figure 15), hereafter "the site" (centred on NGR 430250 274150). The survey forms part of an ongoing programme of archaeological works being undertaken ahead of the proposed development of HS2.

4.2.2 This site, CN016, was selected for geophysical survey as it is located close to known archaeological remains including a possible Deserted Medieval Village (DMV). It is considered to be an area at high risk (risk model score: 2).

Site details

4.2.3 The site comprises one pasture field located off Coventry Road (A429), between Millburn Grange Farm and Cryfield Grange. The site lies approximately 2.3km northeast of the centre of Kenilworth. The limits of the geophysical survey area are defined by the present field boundaries and the site comprises a pasture field that had been mown just before the survey took place. Geophysical survey was undertaken over the whole field with only a small area lost to obstructions, the area of data coverage came to around 2.3ha.

4.2.4 The site lies on an area of gently sloping land that falls away towards the southwest. The northeast region of the site lies at a height a little over 80m aOD (above Ordnance Datum) and falls from this height to less than 75m aOD at the southwest corner. The site occupies the west southwest facing slope of the valley of Canley Brook. This watercourse flows into Finham Brook, further southeast, which flows northwest to join with the River Sowe, close to its confluence with the River Avon.

4.2.5 The solid geology is recorded as barren upper coal measures and pennant series (Carboniferous) with Keuper sandstone (Triassic) close by (Ordnance Survey 1957). There are superficial deposits recorded close to the site although river terrace deposits (Quaternary) may be found close to Canley Brook (Ordnance Survey 1977).

4.2.6 The soils underlying most of the site are likely to be typical brown earths of 541b (Bromsgrove) association with some deposits of stagnogleyic argillic brown earths of the 572e (Whimple 2) association further to the south-western end of the site (SSEW 1983). Soils derived from such geological parent material have been shown to produce magnetic contrasts acceptable for the detection of archaeological remains through magnetometer survey.

Archaeological background

4.2.7 There is only one recorded site located within the survey area which is a pair of undated linear cropmarks observed in a 1965 aerial photograph (MWA4803). The cropmarks appear to be running straight, on a northeast to southwest orientation. There are a number of other sites located within one kilometre that range in date from the prehistoric to the modern period. The most significant records will be discussed only. Desk-Based Assessments (DBAs) should be consulted for a fuller account of the recorded archaeology.

4.2.8 Records relating to the Bronze Age, Neolithic, Mesolithic and Palaeolithic are limited to a number of findspots of flint tools. Findspots include a Neolithic stone axe(MWA2880), Palaeolithic and Mesolithic flint scatters(MWA8359) and a Neolithic/Bronze Age flint scatter(MWA8353).

4.2.9 To the southwest of the site is the findspot of several Roman coins (MWA2882). Further southwest is the site of a possible Roman settlement at Common Lane where gravel paths, foundations, square drain pipes and painted stones have been uncovered (MWA3255). Tradition maintains a Roman road runs through the area, close to the site, but no remains have been found to support this (EH333953 and EH335910).

4.2.10 The most significant medieval records are of two possible Deserted Medieval Villages (DMVs) and two Granges at Millburn and Cryfield Grange. The record for Millburn mentions a series of earthworks that are considered to represent the remains of the settlement (MWA2923). Millburn Grange is located further to the southeast and was a medieval Cistercian agricultural estate associated with Stoneleigh Abbey (MWA8364). Cryfield Grange lies to the north of the site and a DMV is known to have existed around here based on documentary sources (MWA2853). Cryfield Grange was also associated with Stoneleigh Abbey (MWA2852).

4.2.11 A brickyard is suggested to exist close to Cryfield Grange, north of the site, based on documentary sources (MWA8366). There are several records of quarrying sites towards the southeast that are thought to date to the post-medieval period (MWA6936 and MWA2876). Crackley Bridge, located along the A429 southwest of the survey area, is thought to date from at least the post-medieval period (MWA2934). A possible Second World War ammunition stand is visible as cropmarks on aerial photographs, northeast of the site. It is part of a heavy anti-aircraft installation that was identified at this location from documentary sources (MWA9648 and MCT2155)

Methodology

Survey objectives

4.2.12 A Written Scheme of Investigation (WSI) was prepared by Wessex Archaeology which outlined the aims of the survey and the proposed methodology to be followed (Wessex Archaeology 2013). The stated aims include the following:

- to conduct a detailed survey which covers as much of the specified area as possible, allowing for artificial obstructions;
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4.2.22 The gradiometer data are displayed at -2nT (white) to +3nT (black) for the greyscale image and ±25nT at 25nT per cm for the XY trace plots. The XY trace plot images have been produced at a scale of 1:1500.

Results

Introduction

4.2.23 The gradiometer survey has been successful in identifying anomalies of likely and possible archaeological interest, along with numerous trends and at least three modern services. Results are presented as a series of greyscale and XY plots, and archaeological interpretations, at a scale of 1:1500 (Figure 15 to Figure 18).

4.2.24 The interpretation of the datasets highlights the presence of potential archaeological anomalies, ferrous/burnt or fired objects, and magnetic trends (

4.2.25 Figure 18). Full definitions of the interpretation terms used in this report are provided in Appendix 2.

4.2.26 Numerous ferrous anomalies are visible throughout the detailed survey dataset. These are presumed to be modern in provenance and are not referred to, unless considered relevant to the archaeological interpretation.

Interpretation: archaeology

4.2.27 The most noticeable feature in this data is a large T-shaped spread of ferrous responses at 4000 and 4001 that covers a large proportion of the site. The ferrous responses at 4000 appear to represent a dense spread of ferrous and ceramic debris and the response at 4001 represents a modern service, discussed below. The spread at 4000 seems to correspond with a construction track visible on Google Earth from 2007 onwards. The debris could constitute some temporary metalling or waste material from construction. This large spread of ferrous will reduce the area where archaeological features can be detected.

4.2.28 There are a couple of pit-like anomalies at 4002 and 4003; the best example is 4002 that is far larger. It has magnetic values in excess of +3nT, measures 4.6m in length and has a slightly irregular form with a small weaker anomaly very close to it. This feature is considered to represent a large pit and is classed as archaeology; the smaller feature at 4003 is classed as possible archaeology as it is much smaller.

4.2.29 A short but strong linear anomaly is present at 4004; it measures 6m in length and is considered to represent a section of ditch although its function is unclear. This feature is classed as archaeology.

4.2.30 There are a number of linear positive anomalies present in the data at 4005 to 4008. 4005 and 4006 are aligned roughly northeast to southwest and 4006 has a weaker linear feature running parallel to it. The ditch at 4005 has magnetic values around +2nT and appears to have short sections extending perpendicular from it. The ditch continues into the ferrous spread at 4000 and does not appear to be visible the other side of the spread. This feature is considered to represent a ditch and is classed as archaeology (weak response). The parallel ditches at 4006 are more regular in form with the exception of a bulge in the stronger of the two. The weaker example has magnetic values around +1nT and has been termed possible archaeology (weak response) and the stronger one has values around +2nT and has been classed as archaeology (weak response).

4.2.31 The ditch at 4007 is more isolated and is on a roughly perpendicular alignment to 4005. It has magnetic values less than +2nT and has been classed as archaeology (weak response). There is another very weak ditch-like anomaly west of 4008; it has some visible offshoots like 4005 but is much weaker with values less than +1nT. It weakens further towards the north and is represented by a very weak trend of uncertain origin (west of 4009). This feature has been classed as possible archaeology (weak response) due to its very weak contrast.

4.2.32 There are two small L-shaped anomalies around 4010 with very weak magnetic values of less than +1.5nT. They may prove to be archaeological and have been termed possible archaeology (weak response). There are two irregular anomalies in the data around 4011, they have weak positive magnetic values of less than +1.5nT and have a slightly irregular shape. They have been classed as possible archaeology (weak response) due to their slightly irregular form.

4.2.33 There are a few trends in the data around 4004 that are suspected to be ploughing trends. The remaining trends are all classed as uncertain origin as they have no common alignment that might suggest they are related to ploughing activity. Some of these trends, such as the long linear trend west of 4009 and the curved example around 4010, may prove to be archaeological.

4.2.34 The remaining features of interest are a series of small positive anomalies of varying strength. As they have no significant patterning in their spatial distribution they have all been classed as possible archaeology. There are some geological responses further towards the north that are characterised by very weak positive spreads with a very irregular shape in plan.

Interpretation: modern services

4.2.35 One modern service has been identified in the data at 4001; this service appears to be a metallic/ceramic pipe that is running parallel to the northern field boundary.

4.2.36 It is not clear from the geophysical data whether the services identified are in active use or not. Also gradiometer data will not be able to locate and identify all services present on site. This report and accompanying illustrations should not be used as the sole source for service locations and appropriate equipment (e.g. CAT and Genny) should be used to confirm the location of buried services before any trenches are opened on site.

Conclusions

Introduction

4.2.37 The detailed gradiometer survey has been successful in detecting anomalies of likely and possible archaeological interest within the site, in addition to regions of increased magnetic response, numerous trends of uncertain origin and at least one modern service.

Discussion

4.2.38 The data shows a number of archaeological features that may be associated with records of two possible DMVs and associated medieval granges located to the north and south of the survey area. The data has revealed several linear features interpreted as ditches that may correspond with cropmarks observed in this field. The medieval settlements are thought to be located further to the north and south, but this area may represent an extension of the settlements or could represent agricultural features associated with the settlements. It is clear from the existing records that many periods are represented in this area and the features detected could relate to any of them. It is not possible to firmly date the archaeology detected from the geophysical data alone.

4.2.39 The large spread of ferrous at 4000 and 4001 has the potential to obscure archaeological features that may be present under these spreads. Given that the archaeology observed is very weak on the most part this is a real concern.

4.2.40 The relative dimensions of the modern services identified by the gradiometer survey are indicative of the strength of their magnetic response, which is dependent upon the materials used in their construction and the backfill of the service trenches. The physical dimensions of the services indicated may therefore differ from their magnetic extents in plan; it is assumed that the centreline of services is coincident with the centreline of their anomalies. It is difficult to estimate the depth of burial of the services through gradiometer survey.

4.2.41 It should be noted that small, weakly magnetised features may produce responses that are below the detection threshold of magnetometers. It may therefore be the case that more archaeological features may be encountered than have been identified through geophysical survey. Given how weak many of the features interpreted in this data are it seems very likely that more features may be present than were detected during the survey.

References

Bibliography

English Heritage (2008), Geophysical Survey in Archaeological Field Evaluation. Research and Professional Service Guideline No. 1, 2nd Edition

Soil Survey of England and Wales (1983), Sheet 3, Soils of Midland and Western England. Ordnance Survey: Southampton.

Ordnance Survey (1977), Quaternary Map of the United Kingdom: South. Ordnance Survey: Southampton.

Ordnance Survey 1957. Sheet 2, Geological Map of Great Britain: England and Wales. Ordnance Survey: Chessington.

Wessex Archaeology, 2013. HS2: Geophysical Survey Written Scheme of Investigation. Report Reference: 86254.01.

HER records consulted

MCT2155 – Former military dispersal site, Kenilworth Road

MWA2852 – Site of Medieval Grange at Cryfield Grange

MWA2853 – Site of Cryfield Grange Deserted Medieval settlement

MWA2876 – Quarry in "Pit Field", to S of Gibbet Hill

MWA2880 – Findspot, Neolithic stone axe

MWA2882 – Findspot, Roman coins

MWA2923 – Millburn Deserted Medieval settlement

MWA2934 – Crackley Bridge

MWA3255 – Site of possible Roman settlement at Common Lane

MWA4803 – Undated linear cropmark

MWA6936 – Site of Gravel Pits NW of Dale House

MWA8353 – Findspot, Neolithic or Bronze Age flint scatter

MWA8359 – Findspot, Palaeolithic and Mesolithic flint

MWA8364 – Millburn Grange

MWA8366 – Brickyard field names, Cryfield Grange

MWA9648 – Gibbet Hill anti-aircraft artillery site

English heritage pastscape records

Monument No. 333953 – Possible Roman Road

Monument No. 335910 – Possible Roman Road

Figures

Figure 15: Site location

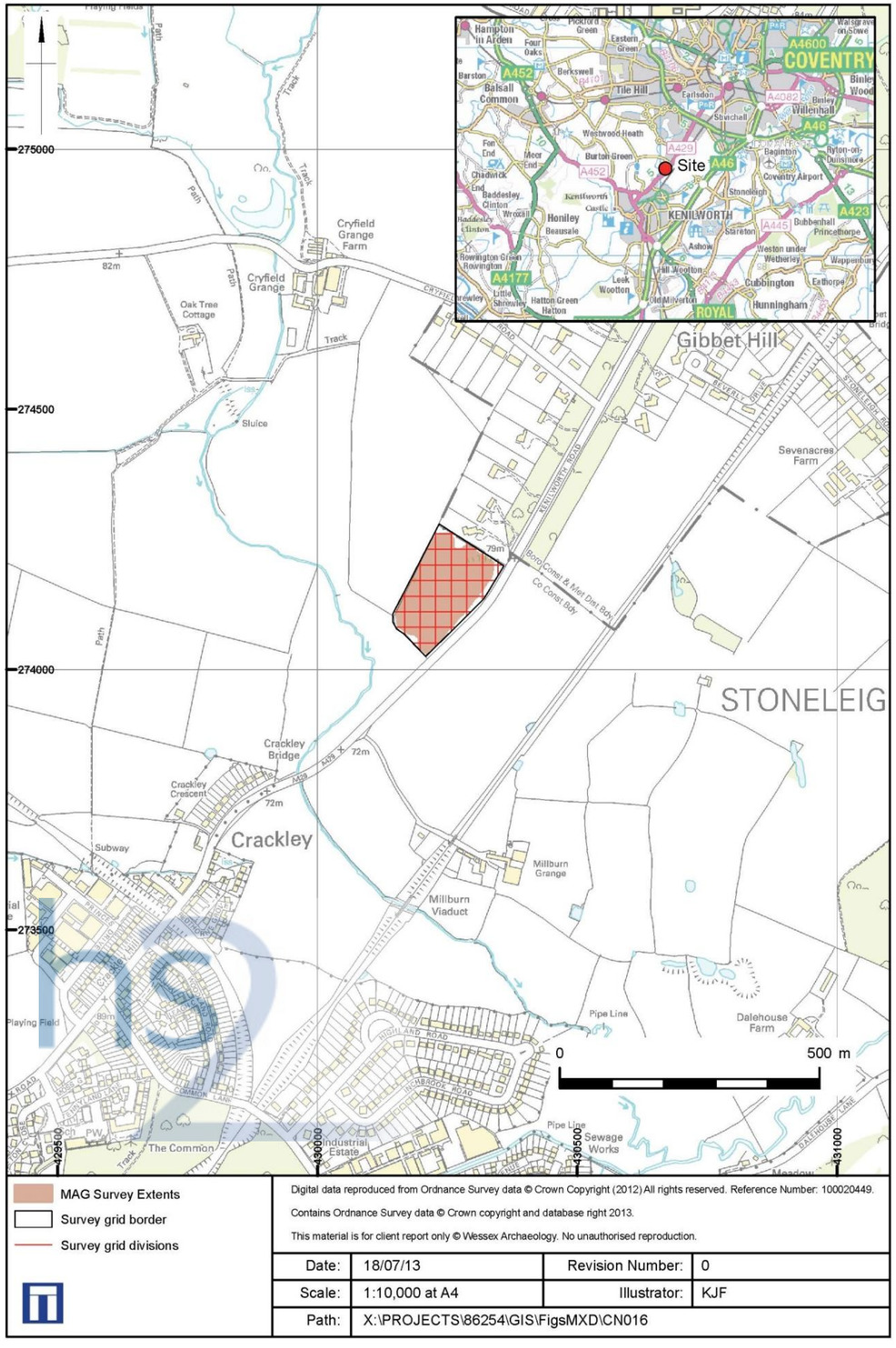

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Figure 16: Greyscale plot

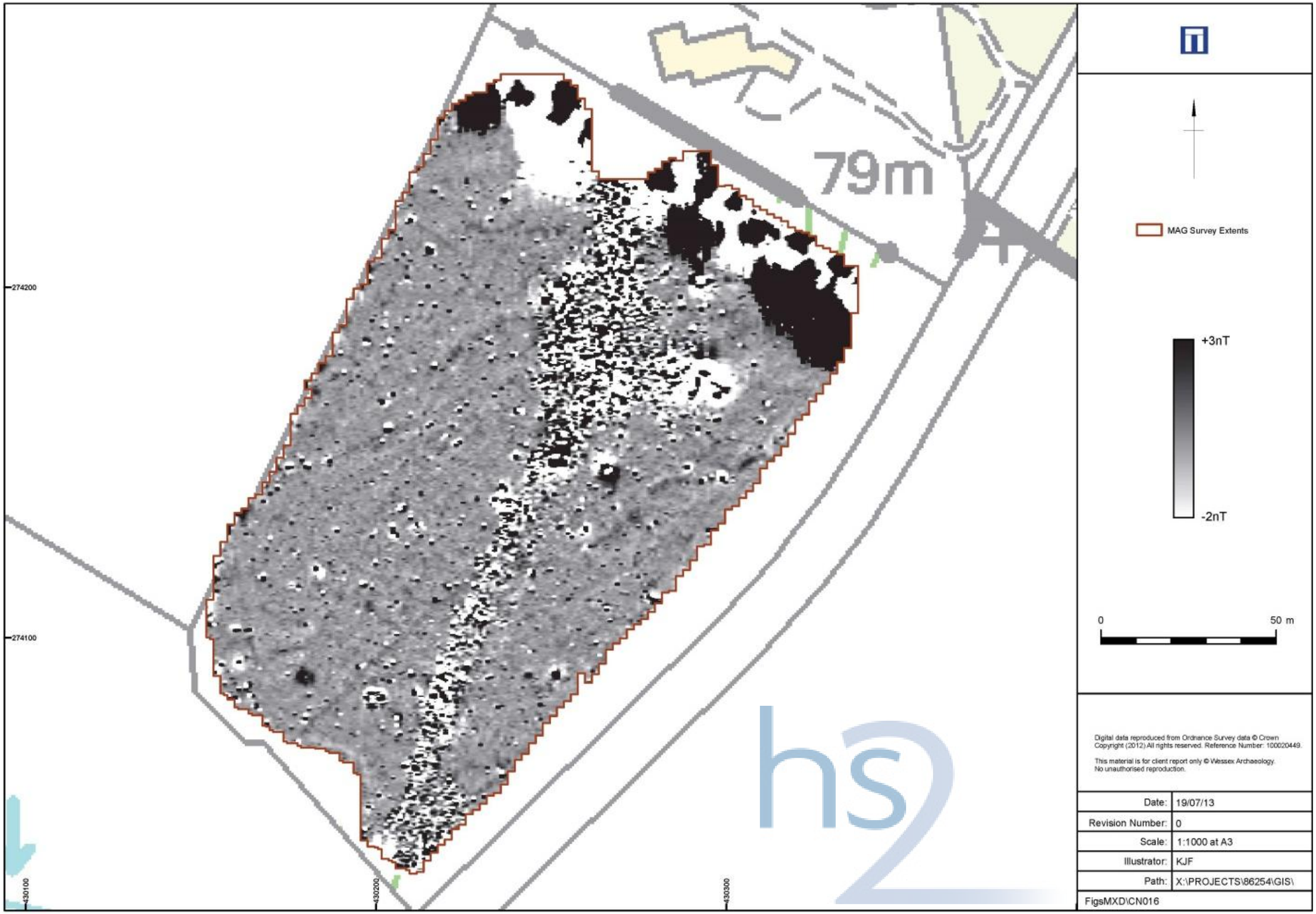


Figure 17: XY Trace

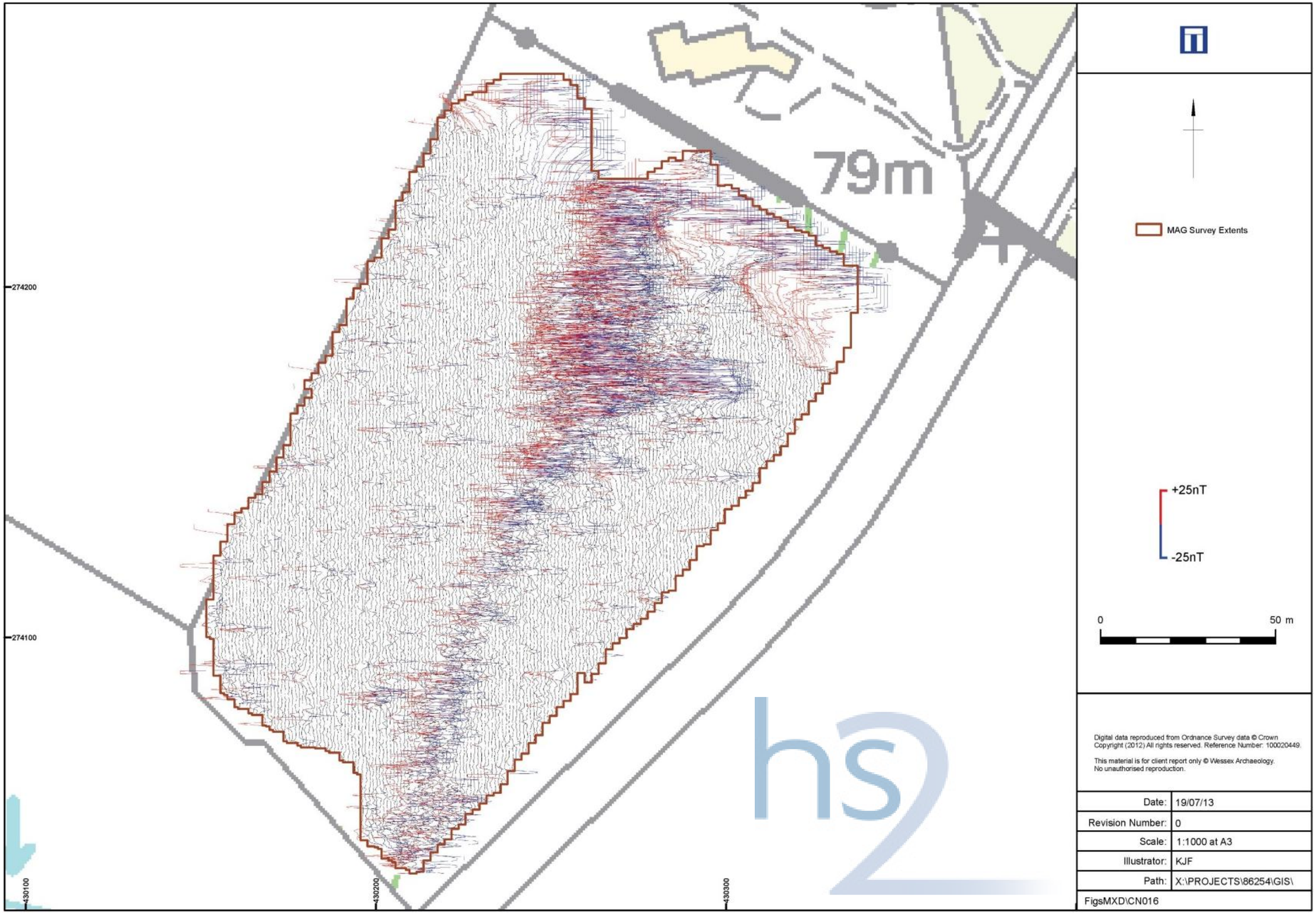
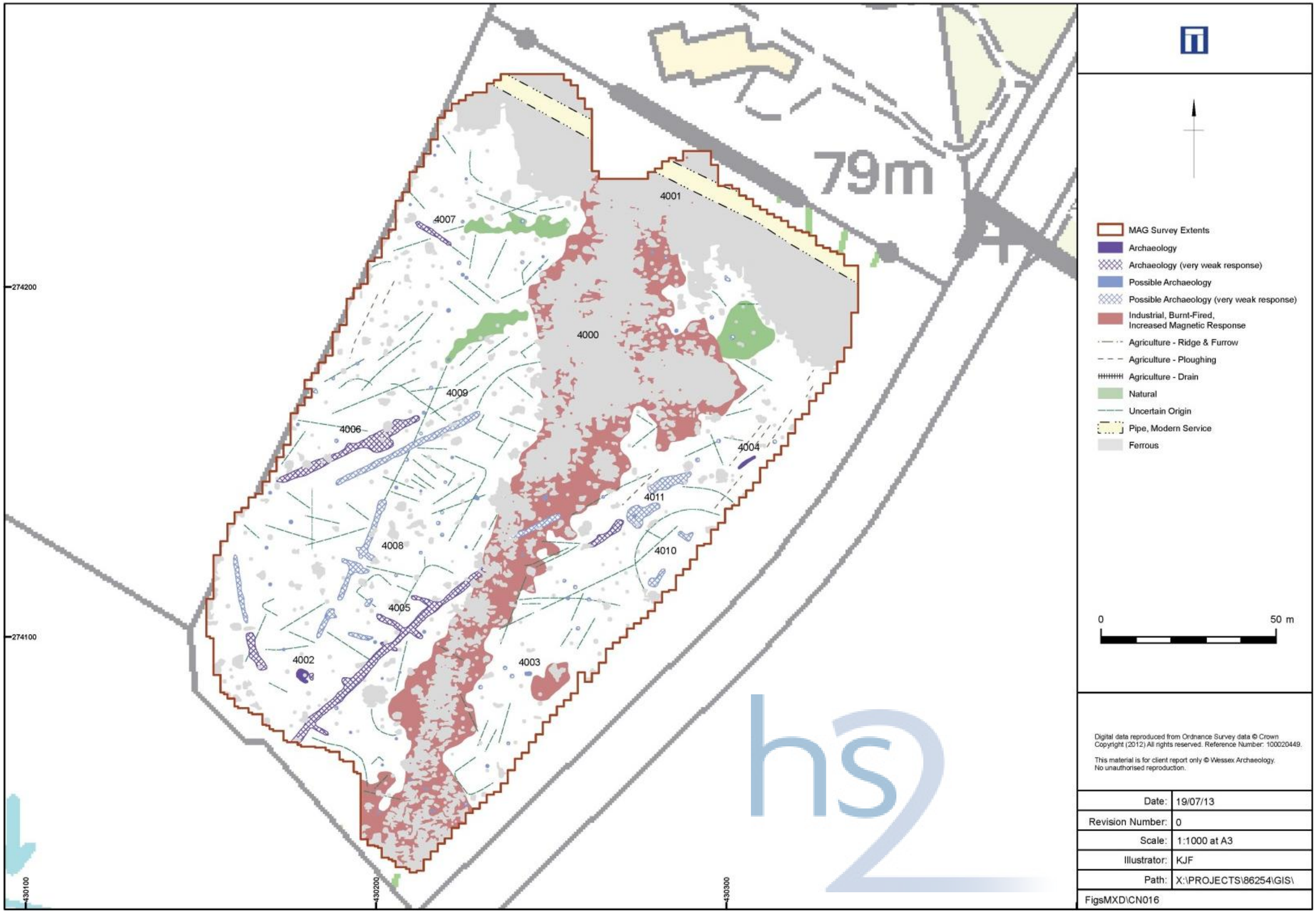


Figure 18: Interpretation



5 Appendix 1. Survey equipment and data processing

5.1 Survey methods and equipment

5.1.1 The magnetic data for this project was acquired using a Bartington 601-2 dual magnetic gradiometer system. This instrument has two sensor assemblies fixed horizontally 1m apart allowing two traverses to be recorded simultaneously. Each sensor contains two fluxgate magnetometers arranged vertically with a 1m separation, and measures the difference between the vertical components of the total magnetic field within each sensor array. This arrangement of magnetometers suppresses any diurnal or low frequency effects.

5.1.2 The gradiometers have an effective resolution of 0.03nT over a ±100nT range, and measurements from each sensor are logged at intervals of 0.25m. All of the data are stored on an integrated data logger for subsequent post-processing and analysis.

5.1.3 Wessex Archaeology conducts detailed gradiometer surveys using an accurate 20m or 30m site grid, which is achieved using a Leica Viva RTK GNSS instrument and then extended using tapes. The Leica Viva system receives corrections from a network of reference stations operated by the Ordnance Survey and Leica Geosystems, allowing positions to be determined with a precision of 0.02m in real-time and therefore exceed the level of accuracy recommended by English Heritage (2008) for geophysical surveys.

5.1.4 The detailed surveys consist of 20m x 20m or 30m x 30m grids, and data are collected at 0.25m intervals along traverses spaced 1m apart. These strategies give 1600 or 3600 measurements per 20m or 30m grid respectively, and are the recommended methodologies for archaeological surveys of this type (EH 2008).

5.1.5 Data may be collected with a higher sample density where complex archaeological anomalies are encountered, to aid the detection and characterisation of small and ephemeral features. Data may be collected at up to 0.125m intervals along traverses spaced up to 0.25m apart, resulting in a maximum of 28800 readings per 30m grid, exceeding that recommended by English Heritage (2008) for characterisation surveys.

5.2 Post-processing

5.2.1 The magnetic data collected during the detail survey are downloaded from the Bartington system for processing and analysis using both commercial and in-house software. This software allows for both the data and the images to be processed in order to enhance the results for analysis; however, it should be noted that minimal data processing is conducted so as not to distort the anomalies.

5.2.2 As the scanning data are not as closely distributed as with detailed survey, they are georeferenced using the GPS information and interpolated to highlight similar anomalies in adjacent transects. Directional trends may be removed before interpolation to produce more easily understood images.

5.2.3 Typical data and image processing steps may include:

- destripe – applying a zero mean traverse in order to remove differences caused by directional effects inherent in the magnetometer;
- destagger – shifting each traverse longitudinally by a number of readings. This corrects for operator errors and is used to enhance linear features;
- despike – filtering isolated data points that exceed the mean by a specified amount to reduce the appearance of dominant anomalous readings (generally only used for earth resistance data);
- deslope – this function is used to remove a linear trend within a data set. It is most commonly used to remove grid edge discontinuities that can result from applying zero mean traverse to a data set; and
- multiply – the multiply function multiplies the data by a negative or positive constant value. It has a variety of functions but its typical use is to normalise data that has been collected with sensors at different heights from the ground.

5.2.4 Typical displays of the data used during processing and analysis:

- XY plot – presents the data as a trace or graph line for each traverse. Each traverse is displaced down the image to produce a stacked profile effect. This type of image is useful as it shows the full range of individual anomalies; and
- greyscale – presents the data in plan view using a greyscale to indicate the relative strength of the signal at each measurement point. These plots can be produced in colour to highlight certain features but generally greyscale plots are used during analysis of the data.

6 Appendix 2: Geophysical interpretation

6.1 Interpretation categories

6.1.1 The interpretation methodology used by Wessex Archaeology separates the anomalies into two main categories: archaeological and unidentified responses.

6.1.2 The archaeological category is used for features when the form, nature and pattern of the anomaly are indicative of archaeological material. Further sources of information such as aerial photographs may also have been incorporated in providing the final interpretation. This category is further sub-divided into three groups, implying a decreasing level of confidence:

- archaeology – used when there is a clear geophysical response and anthropogenic pattern;
- possible archaeology – used for features which give a response but which form no discernible pattern or trend; and
- the unidentified category is used for features when the form, nature and pattern of the anomaly are not sufficient to warrant a classification as an archaeological feature. This category is further sub-divided into:
  - industrial, burnt-fired, increased magnetic response – used for areas dominated by bipolar and dipolar anomalies which may have some archaeological potential;
  - uncertain origin – used for low amplitude or indistinct linear anomalies;
  - ferrous – used for responses caused by ferrous material. These anomalies are likely to be of modern origin;
  - agricultural – used for linear trends that can be shown to relate to agricultural activity including ridge and furrow, drainage and ploughing scars; and
  - natural – used for spreads of anomalies that are considered to be geological or more discrete anomalies considered to be natural.

6.1.3 Finally, services such as water pipes are marked where they have been identified along with ceramic field drains.